

US010829929B1

(12) **United States Patent**
Hansen

(10) **Patent No.:** **US 10,829,929 B1**
(45) **Date of Patent:** **Nov. 10, 2020**

(54) **SYSTEM AND METHOD FOR ASSEMBLING STRUCTURAL INSULATED PANELS**

(71) Applicant: **Greggory Hansen**, Lafayette, CA (US)

(72) Inventor: **Greggory Hansen**, Lafayette, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **16/721,834**

(22) Filed: **Dec. 19, 2019**

(51) **Int. Cl.**
E04B 1/61 (2006.01)
E04B 1/14 (2006.01)

(52) **U.S. Cl.**
CPC *E04B 1/6162* (2013.01); *E04B 1/14* (2013.01)

(58) **Field of Classification Search**
CPC E04B 2002/7461; E04B 2002/7474; E04B 2002/0243; E04B 2002/0245; E04B 2002/0247; E04B 1/6145; E04B 1/6162; E04B 1/14; E04B 1/6137; E04B 1/6141; E04B 2/7425; E04B 2/705; E04B 2/7433; E04B 2/7437; E04B 2/7444; E04B 2002/7446; E04B 2002/7462; E04B 2002/7464; E04B 2002/7487; E04C 2/296; E04C 2/292; F16B 5/0052; A63D 33/105; E04F 2201/05
USPC 52/794.1, 464, 586.1, 586.2, 585.1
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

468,435 A * 2/1892 Brock E04C 2/292 52/792.1
1,018,987 A * 2/1912 Vertiska E04F 15/04 52/177

1,537,678 A * 5/1925 Jensen E06B 3/9845 403/294
1,695,553 A * 12/1928 Jones A63H 33/105 52/281
1,723,306 A * 8/1929 Sipe E04B 1/615 52/396.04
1,799,729 A * 4/1931 Cadwallader E04F 15/04 52/586.1
2,018,911 A * 10/1935 Brill E04B 1/6112 52/232

(Continued)

FOREIGN PATENT DOCUMENTS

CN 101942882 A 1/2011
CN 106320564 A 1/2017

(Continued)

OTHER PUBLICATIONS

Structural Insulated Panels (SIPs). URL: <https://basc.pnnl.gov/resource-guides/structural-insulated-panels-sips#quicktabs-guides=1>; Date Accessed: Mar. 19, 2019.

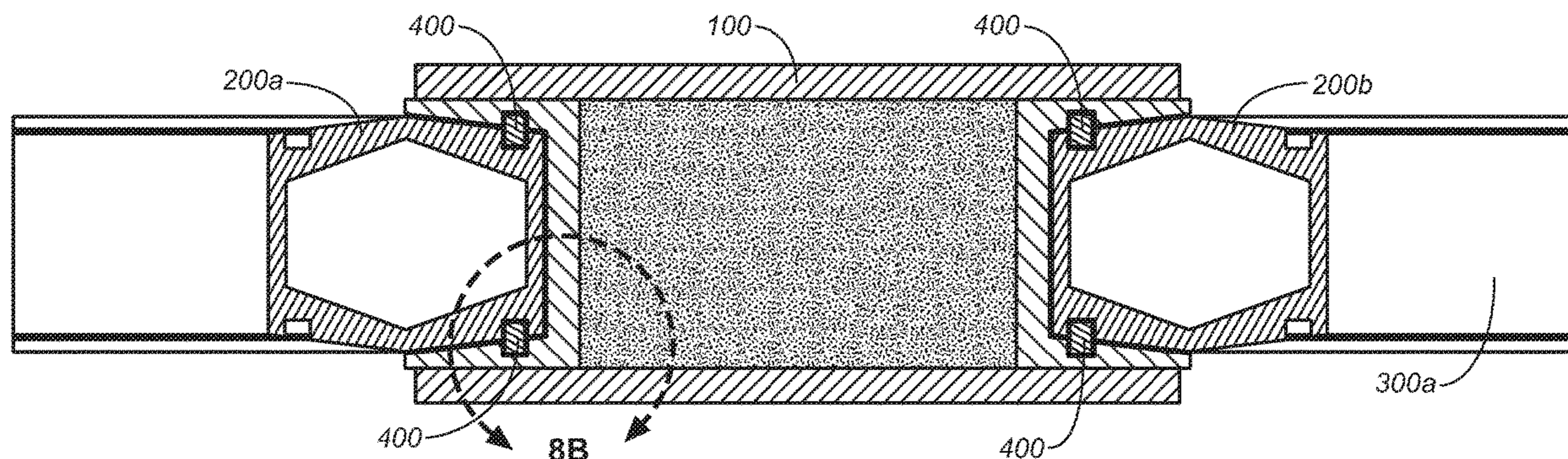
(Continued)

Primary Examiner — Kyle J. Walraed-Sullivan
(74) *Attorney, Agent, or Firm* — Brian Beverly; Beeson Skinner Beverly, LLP

(57) **ABSTRACT**

A system for assembling structural insulated panels (SIPs) includes a set of splines that snugly insert into channels along the top, bottom and side edges of each SIP. Vertical alignment splines are used to align and connect adjacent SIPs and horizontal plate splines are used to cap edge channels of a SIP such that the edges of the SIP can securely rest on, support or be affixed to a foundation or other structural member. The system components facilitate fast and precise alignment, interconnection and installation of SIPs in order to form walls, floors, roofs or foundation systems.

15 Claims, 23 Drawing Sheets



(56)

References Cited

U.S. PATENT DOCUMENTS

2,394,443	A *	2/1946	Guignon, Jr.	E04B 1/617 52/580	5,881,515	A *	3/1999	George	A63H 33/044 403/294
2,863,185	A *	12/1958	Riedi	F16B 5/0076 403/297	5,950,389	A	9/1999	Porter	
3,563,582	A *	2/1971	Shroyer	E04B 1/6154 52/309.13	6,029,831	A *	2/2000	Miller	E04B 2/7425 211/182
3,583,118	A *	6/1971	Lowery	E04B 1/6175 52/309.5	6,050,033	A *	4/2000	Wrightman	E04B 1/26 403/13
3,640,039	A *	2/1972	McKee	E04B 1/6158 52/281	6,058,671	A *	5/2000	Strickland	E04B 1/6137 411/539
3,641,730	A *	2/1972	Meckstroth	E04B 1/6133 52/586.2	6,112,485	A *	9/2000	Beyer	E04B 2/7437 52/239
3,660,952	A *	5/1972	Wilson	E04B 1/10 52/81.4	6,119,427	A *	9/2000	Wyman	E04B 1/12 52/127.11
3,680,277	A *	8/1972	Martin	E04B 1/6154 52/438	6,186,691	B1 *	2/2001	Rudolf-Bauer	E04B 1/6813 403/31
3,686,817	A *	8/1972	Adams	E04B 1/6154 52/586.2	6,272,802	B1 *	8/2001	Berberich	E04B 2/708 52/233
3,766,696	A *	10/1973	Totoonchie	E04B 1/6162 52/241	6,279,287	B1 *	8/2001	Meadows	E04C 2/292 52/309.9
3,866,370	A *	2/1975	Guarino	E04B 2/7403 52/241	6,308,491	B1	10/2001	Porter	
3,922,830	A *	12/1975	Guarino	E04B 2/7403 52/794.1	6,338,231	B1 *	1/2002	Enriquez	E04B 1/04 52/258
4,067,165	A *	1/1978	Timmons	E04B 2/7425 52/238.1	6,481,172	B1 *	11/2002	Porter	B32B 5/18 52/506.01
4,443,988	A *	4/1984	Coutu, Sr.	E04B 1/80 52/309.2	6,799,404	B2 *	10/2004	Spransy	E04B 9/02 160/87
4,532,747	A *	8/1985	Koetje	B63B 3/18 29/507	8,074,418	B2 *	12/2011	Thiagarajan	E04C 2/543 403/290
4,545,168	A *	10/1985	Dalton, Jr.	E04B 1/6108 52/239	8,147,162	B1 *	4/2012	Burnett	F16B 5/0052 312/263
4,652,170	A *	3/1987	Lew	E04B 1/617 403/381	8,151,539	B2 *	4/2012	Grinsted	E04C 2/205 52/220.2
4,712,942	A *	12/1987	Brown	F16B 5/00 403/174	8,286,399	B2 *	10/2012	Brown	E04B 1/14 52/404.4
4,716,692	A *	1/1988	Harper	E04B 2/7425 52/239	8,322,104	B2 *	12/2012	Fleming, III	B32B 3/06 160/87
4,982,535	A *	1/1991	Pickett	E01F 8/0023 256/16	8,371,080	B2 *	2/2013	Wrightman	E04B 2/705 52/233
5,014,476	A *	5/1991	Leslie	E04B 1/6162 52/220.2	8,615,963	B2 *	12/2013	Wrightman	F16B 5/0052 52/233
5,062,250	A	11/1991	Buzzella		8,943,767	B2 *	2/2015	Lewis	E04D 13/0335 52/20
5,097,643	A *	3/1992	Wittler	E04B 2/7425 160/135	9,328,506	B2 *	5/2016	Gibson	E04B 1/76
5,165,212	A *	11/1992	Arnold	E04B 2/707 52/265	9,650,785	B2 *	5/2017	Yu	E04C 2/521
5,172,532	A *	12/1992	Gibbar, Jr.	E04B 2/8652 52/309.12	10,246,873	B1 *	4/2019	Costanza	E04B 1/6141
5,179,810	A *	1/1993	Gename	E04B 2/7409 160/135	10,487,495	B2 *	11/2019	Schilcher	E04B 1/6162
5,216,861	A *	6/1993	Meyerson	E04B 1/617 29/897.35	2002/0170259	A1 *	11/2002	Ferris	E01C 5/00 52/596
5,348,778	A *	9/1994	Knipp	B32B 3/06 312/400	2004/0010991	A1	1/2004	Felser	
5,368,416	A *	11/1994	Cataldo	E01F 8/0011 405/258.1	2004/0134162	A1	7/2004	Douglas	
5,424,118	A *	6/1995	McLaughlin	E04B 1/6183 428/314.8	2004/0177575	A1 *	9/2004	Posselt	E04B 2/702 52/282.1
5,577,356	A *	11/1996	Hubbard	E04B 2/702 52/233	2006/0230700	A1 *	10/2006	Chen	E04C 2/20 52/586.1
5,617,686	A	4/1997	Gallagher, Jr.		2006/0248825	A1 *	11/2006	Garringer	E04B 2/705 52/233
5,628,158	A *	5/1997	Porter	E04C 2/296 52/309.9	2007/0163197	A1 *	7/2007	Payne	E04B 1/14 52/586.1
5,649,401	A	7/1997	Harrington, Jr.		2007/0175158	A1 *	8/2007	Cope	E04B 1/2604 52/585.1
5,651,220	A *	7/1997	dit Felix	E04B 1/3211 52/285.3	2007/0251181	A1 *	11/2007	Dupont	E04F 13/0805 52/586.1
5,664,386	A *	9/1997	Palmersten	E04B 1/6129 52/586.1	2007/0294967	A1 *	12/2007	Posselt	E04B 2/702 52/233
5,701,708	A *	12/1997	Taraba	E04B 1/14 52/210	2009/0056251	A1 *	3/2009	Wrightman	E04B 2/705 52/233
					2009/0100780	A1 *	4/2009	Mathis	E04B 1/14 52/578
					2009/0193735	A1 *	8/2009	Kalinowski	E04B 2/60 52/281
					2009/0199497	A1 *	8/2009	Wrightman	E04B 2/705 52/233
					2009/0205277	A1 *	8/2009	Gibson	E04B 7/22 52/309.9
					2009/0241460	A1 *	10/2009	Beaulieu	E04B 1/6129 52/586.2

(56)

References Cited

U.S. PATENT DOCUMENTS

2010/0011699 A1* 1/2010 Weimer E04B 2/7401
52/745.1
2010/0284751 A1* 11/2010 Price E04C 1/395
405/284
2010/0325990 A1* 12/2010 Taraba E04C 2/34
52/302.1
2011/0047922 A1* 3/2011 Fleming, III B32B 3/06
52/582.1
2011/0173925 A1* 7/2011 Brown E04B 1/14
52/794.1
2012/0198781 A1* 8/2012 Wrightman E04B 2/705
52/233
2013/0227902 A1* 9/2013 Van Sloun E04C 2/296
52/309.4
2013/0239507 A1* 9/2013 Fleming, III B32B 21/08
52/582.1
2014/0208673 A1* 7/2014 Huang E04B 2/7401
52/234
2014/0250827 A1 9/2014 Gillman
2016/0002913 A1* 1/2016 Schilcher E04B 1/10
52/586.2

2016/0032585 A1* 2/2016 Park E04C 1/00
52/592.6
2016/0053491 A1* 2/2016 Fleming, III B32B 21/08
52/586.1
2016/0153191 A1* 6/2016 Henderson E04C 2/46
52/220.2
2018/0298600 A1 10/2018 Moss

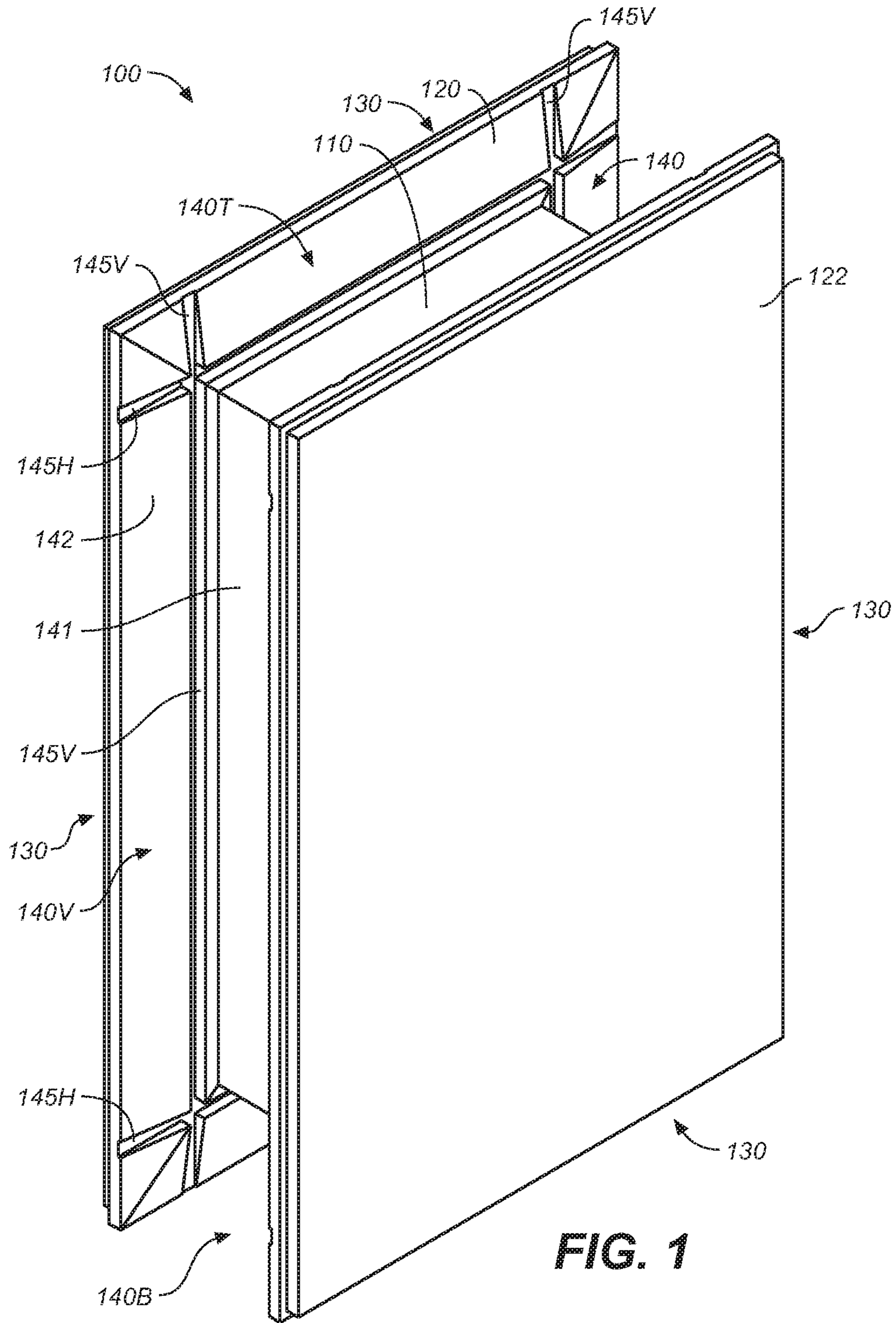
FOREIGN PATENT DOCUMENTS

DE	19745840	A1	4/1999
EP	0644337	A1	3/1995
GB	1448683	A	9/1976
GB	2451275	A	7/2007
WO	2010148460	A1	12/2010
WO	2011033289	A1	3/2011

OTHER PUBLICATIONS

SIP Dual Plywood Spline Joint. URL: <https://www.greenbuildingadvisor.com/cad/detail/sip-dual-plywood-spline-joint>; Date Accessed: Mar. 19, 2019.

* cited by examiner



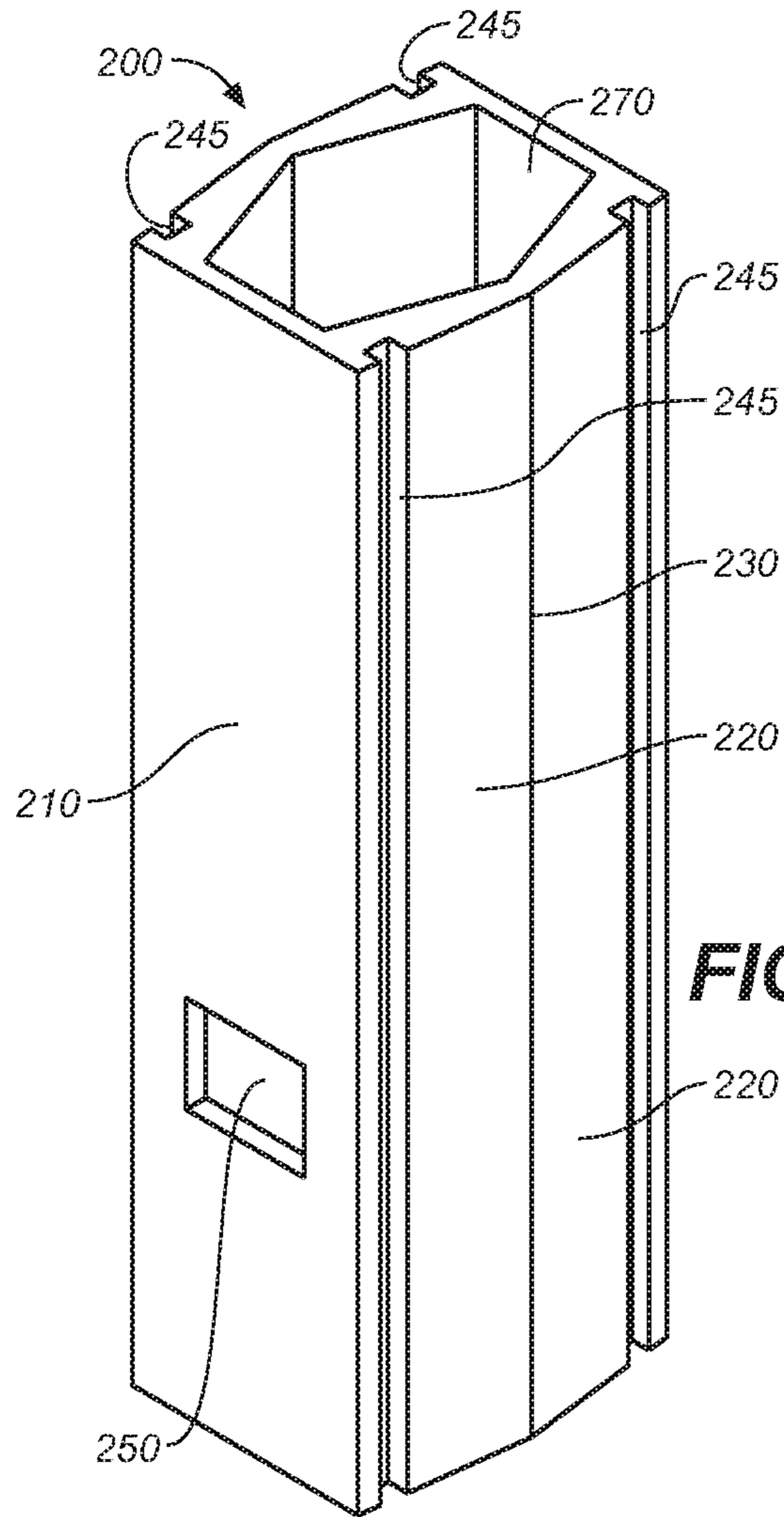


FIG. 2

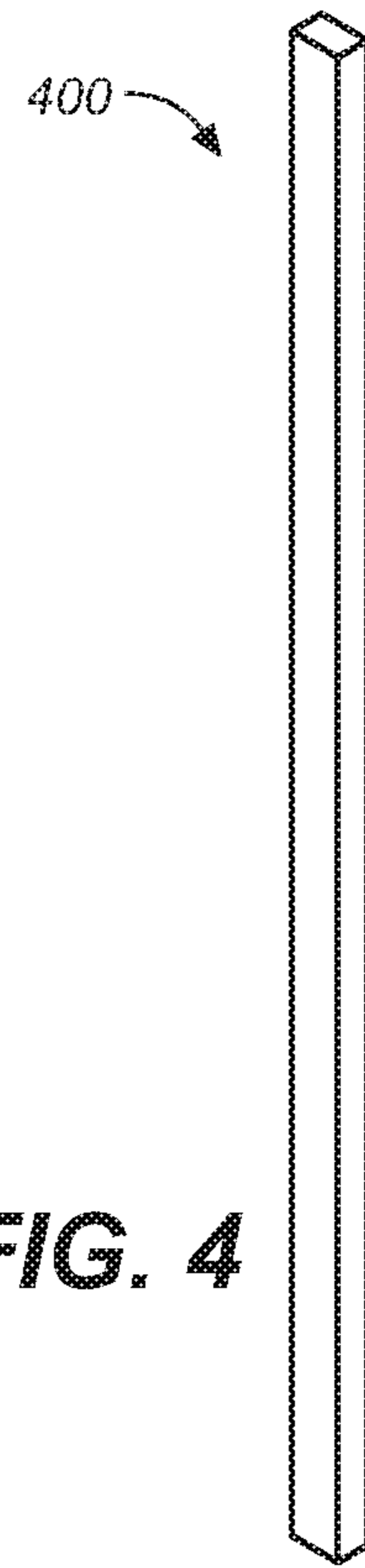


FIG. 4

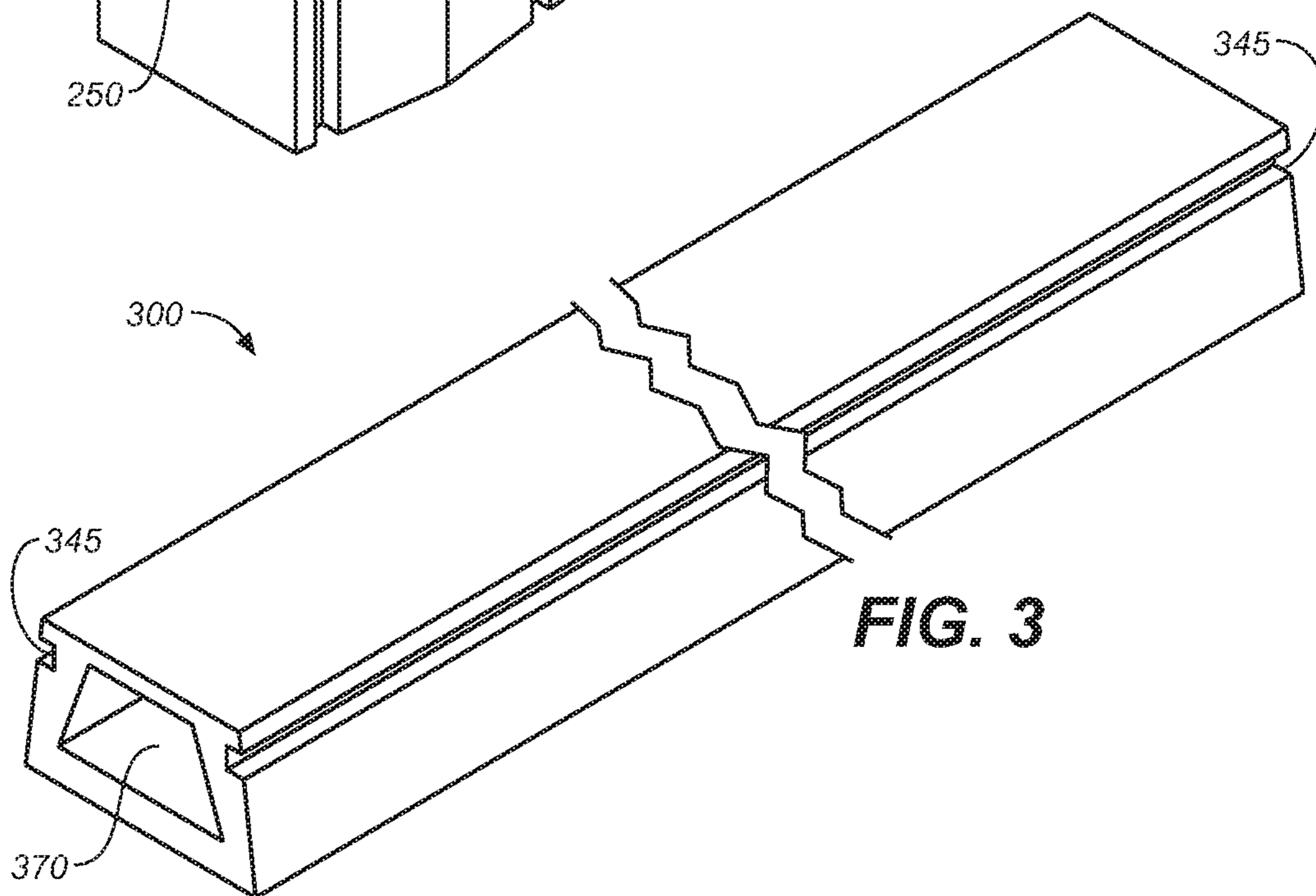


FIG. 3

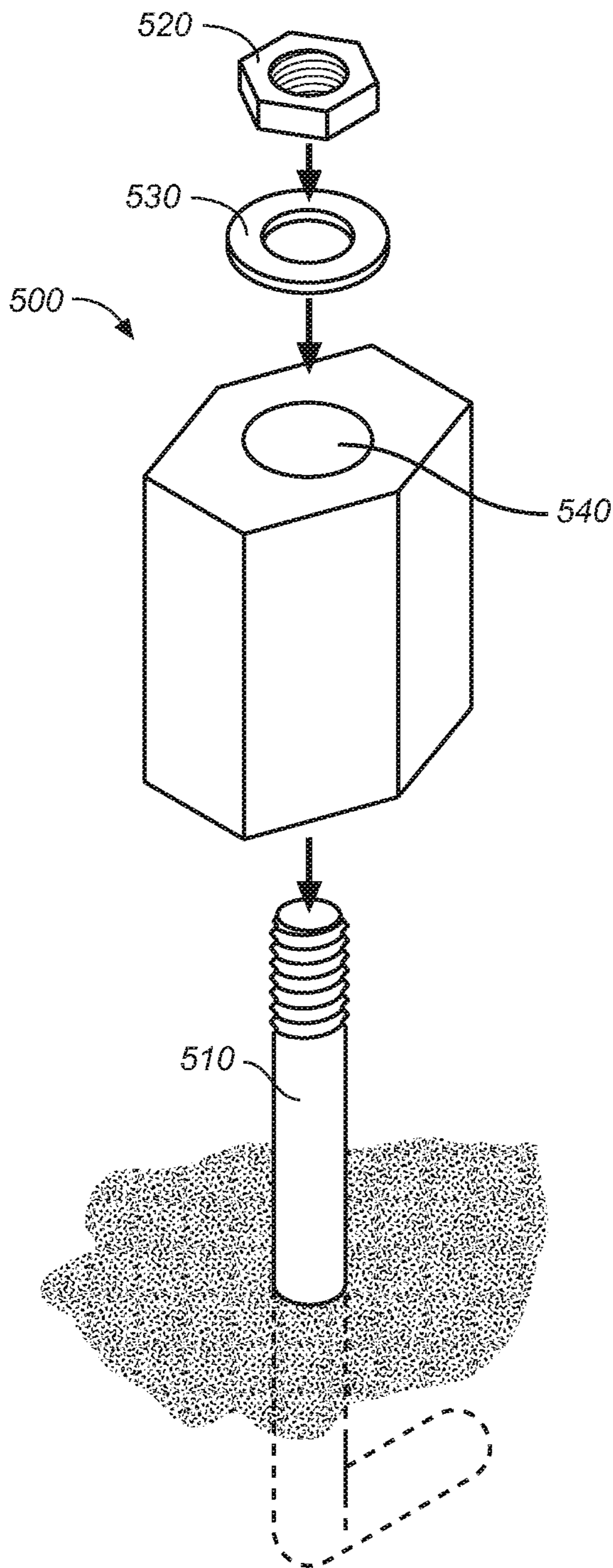


FIG. 5A

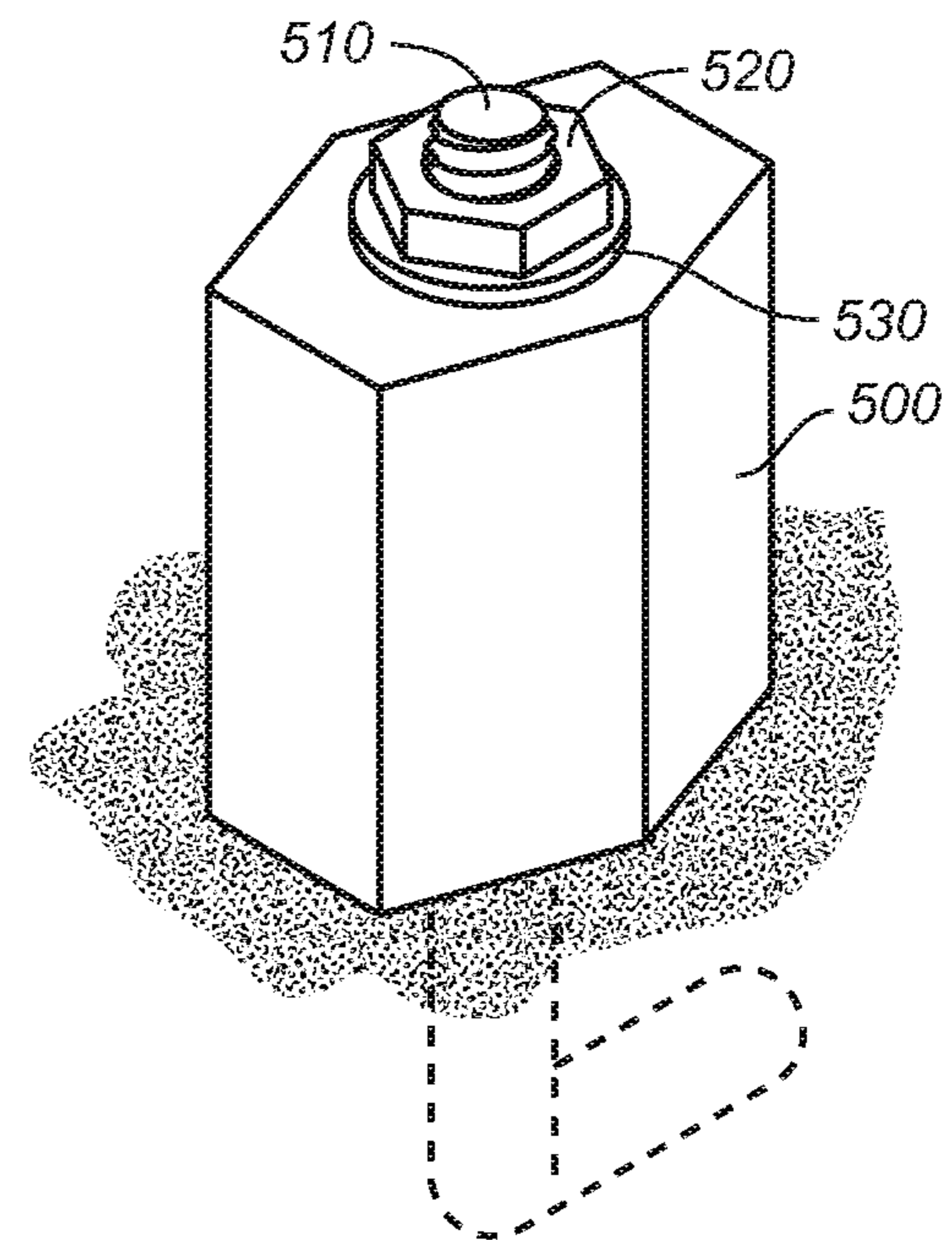


FIG. 5B

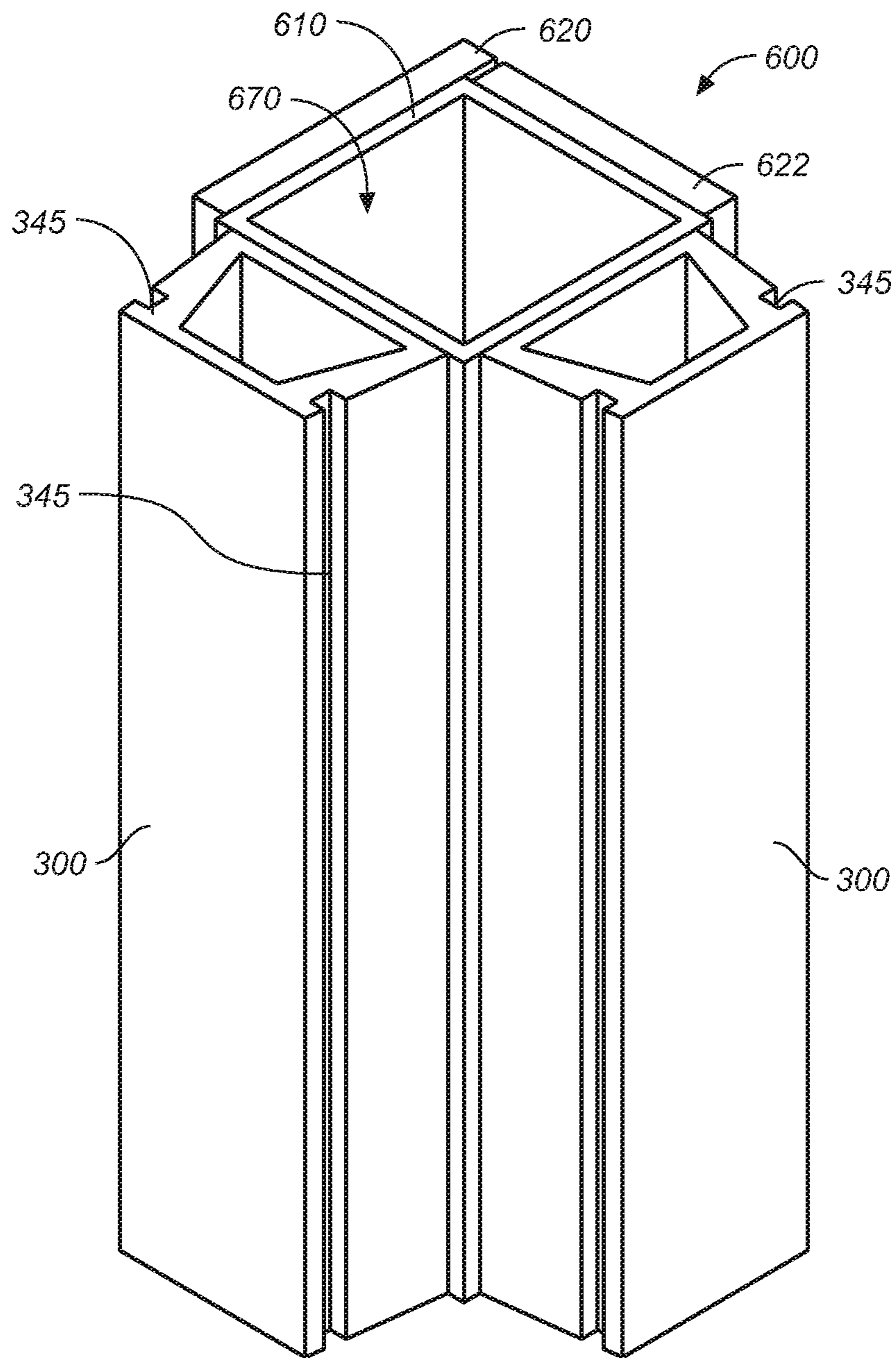


FIG. 6

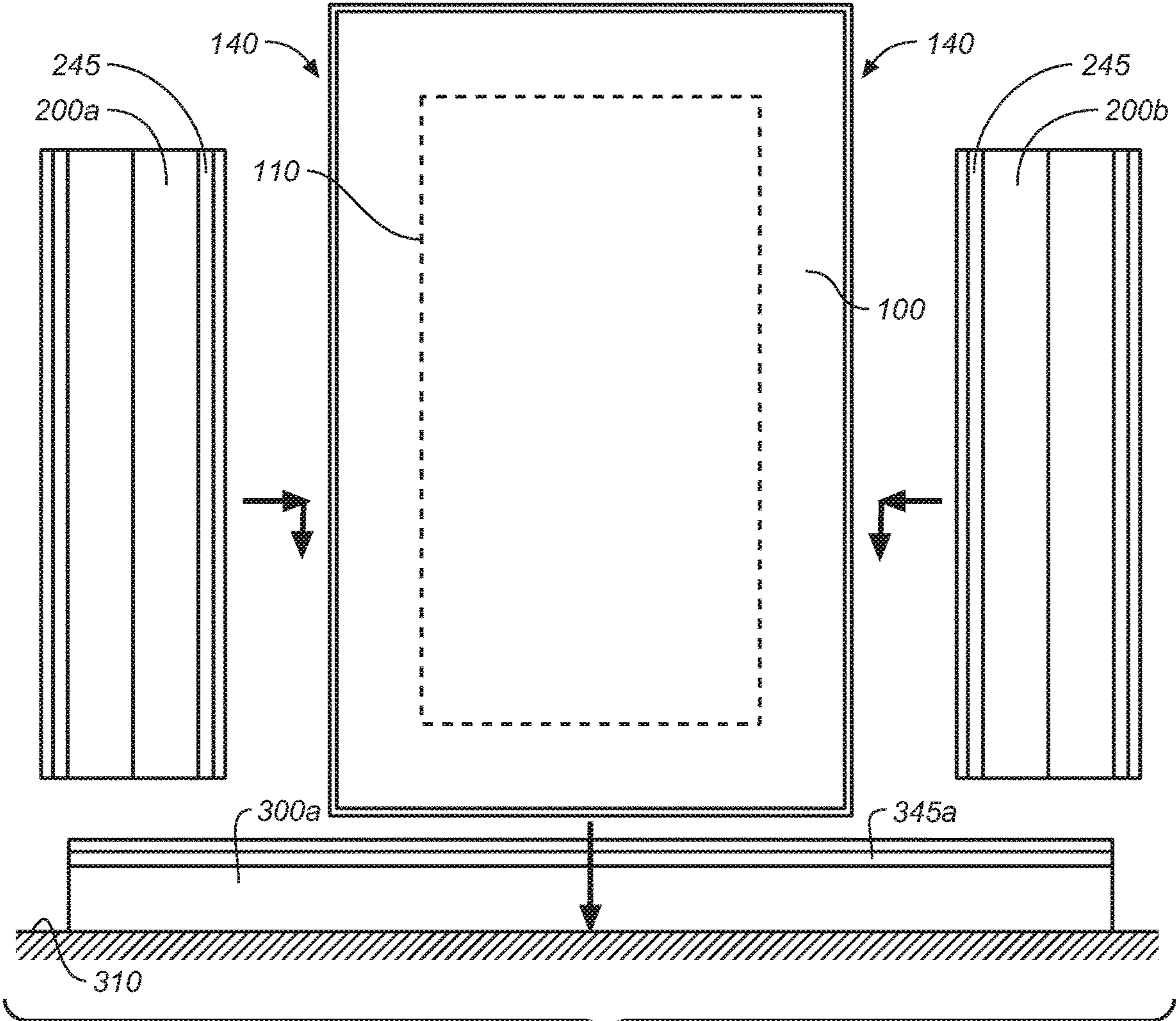


FIG. 7A

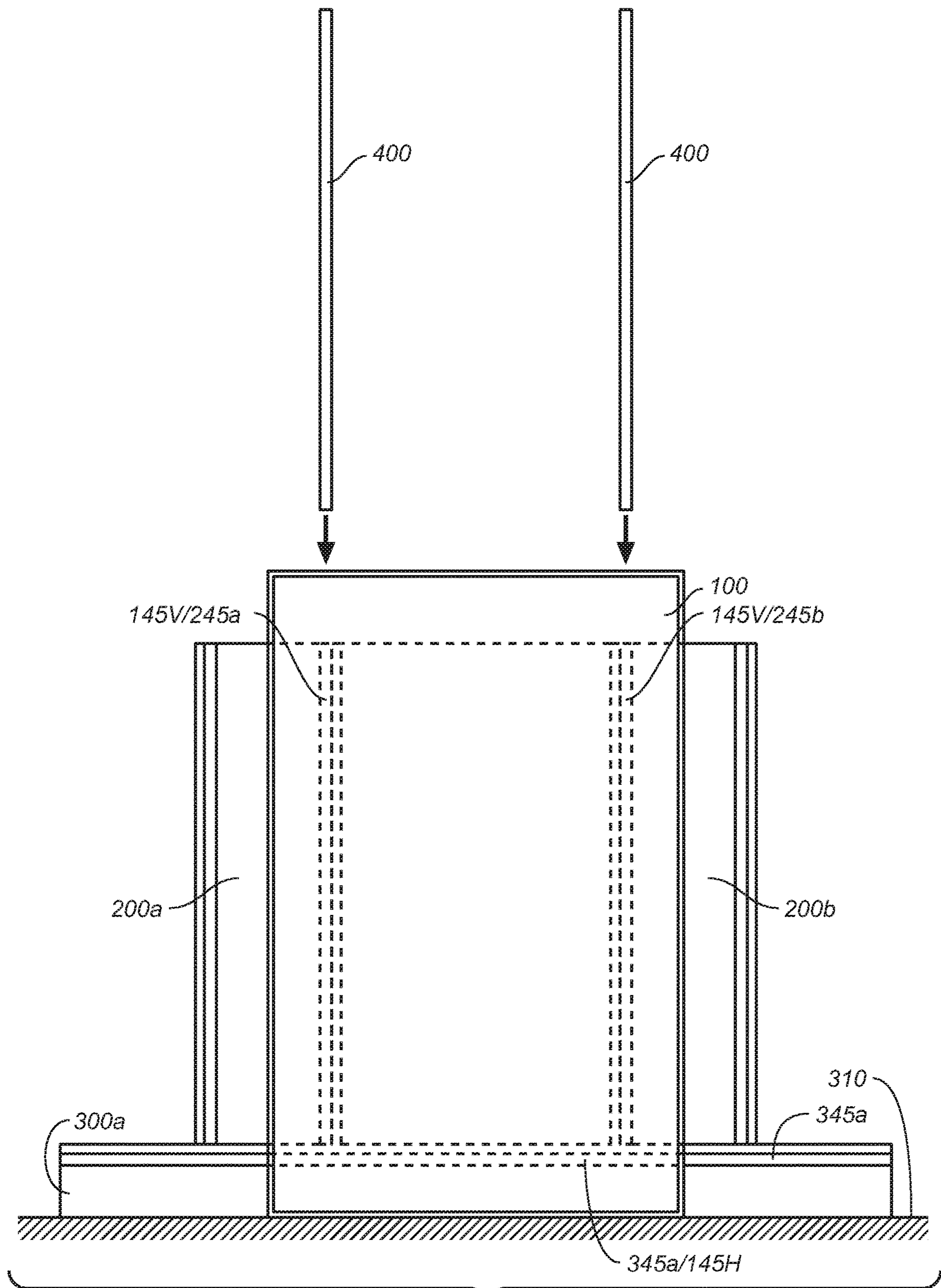


FIG. 7B

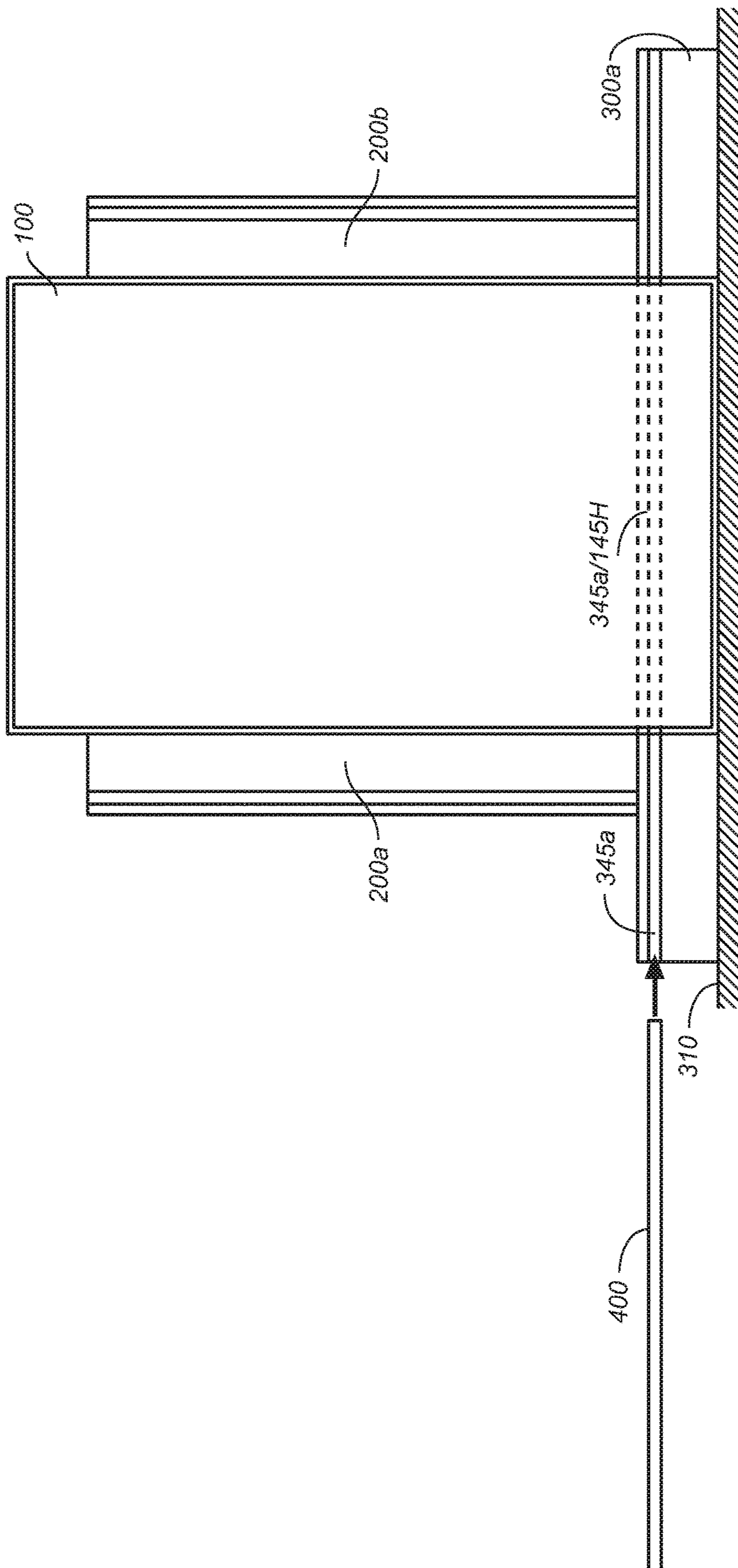


FIG. 7C

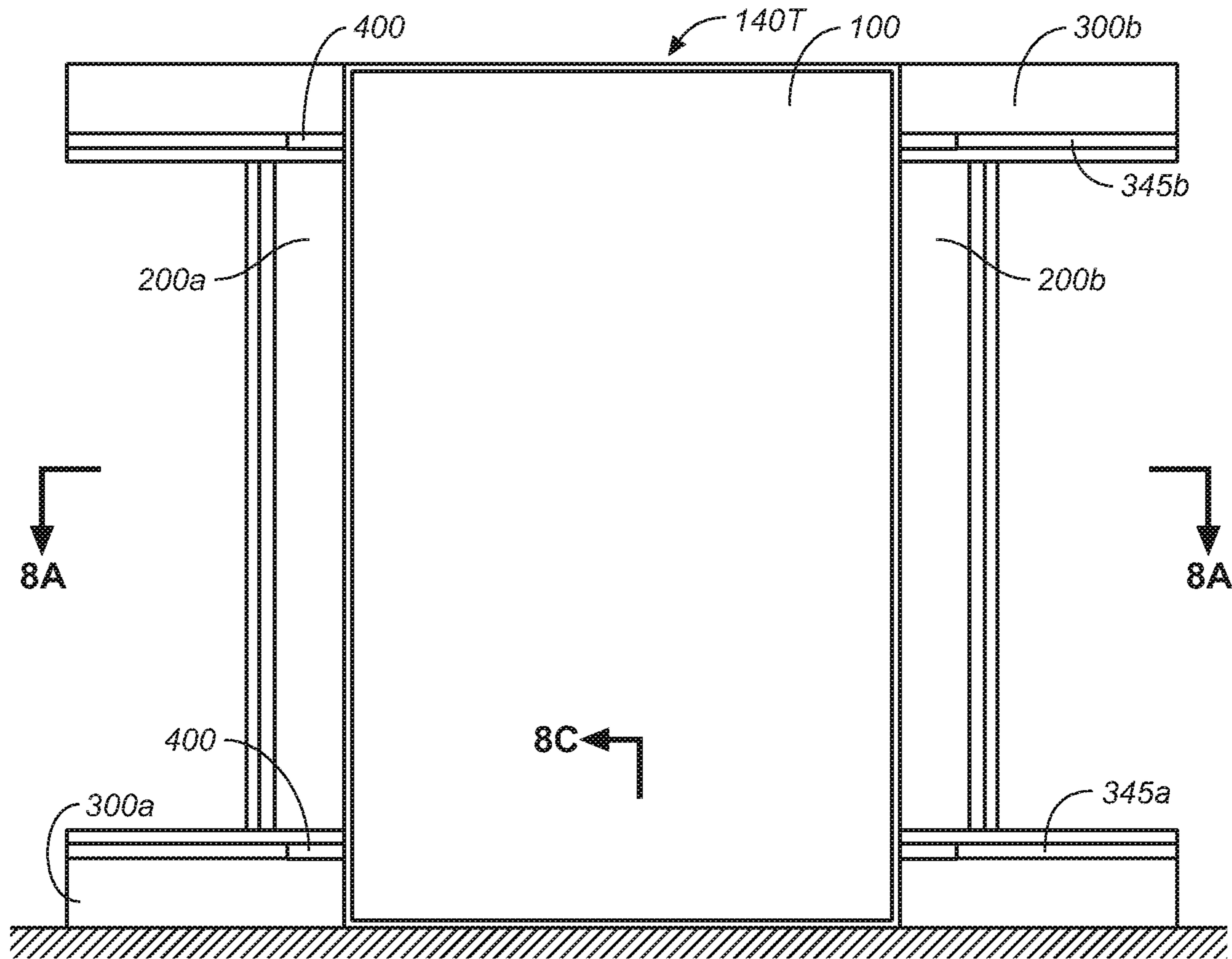


FIG. 7D

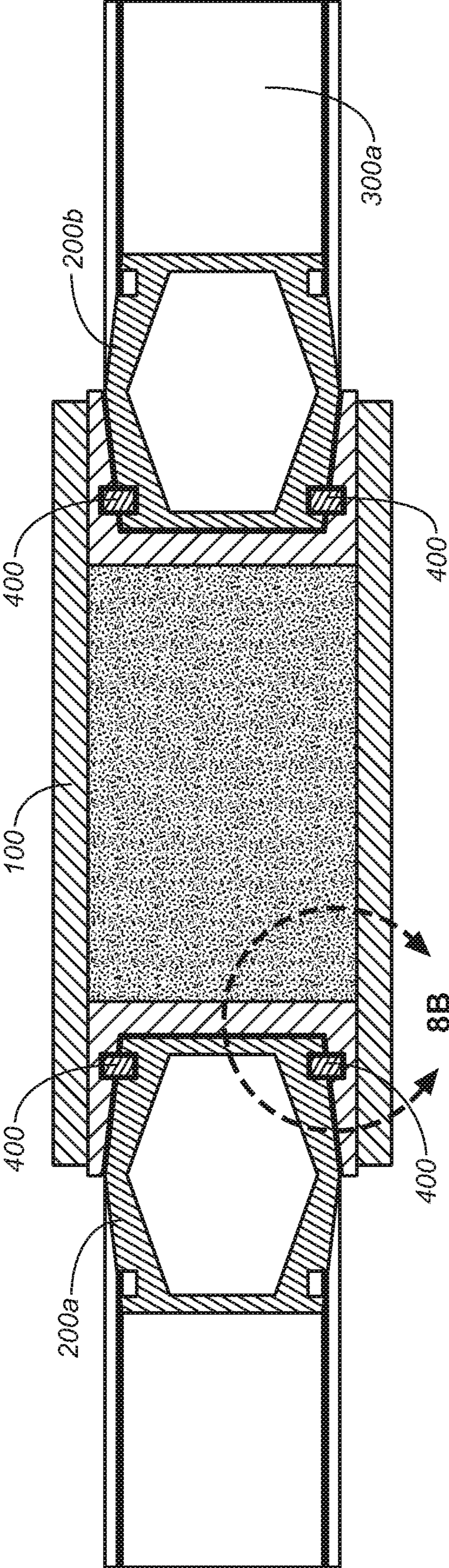


FIG. 8A

FIG. 8B

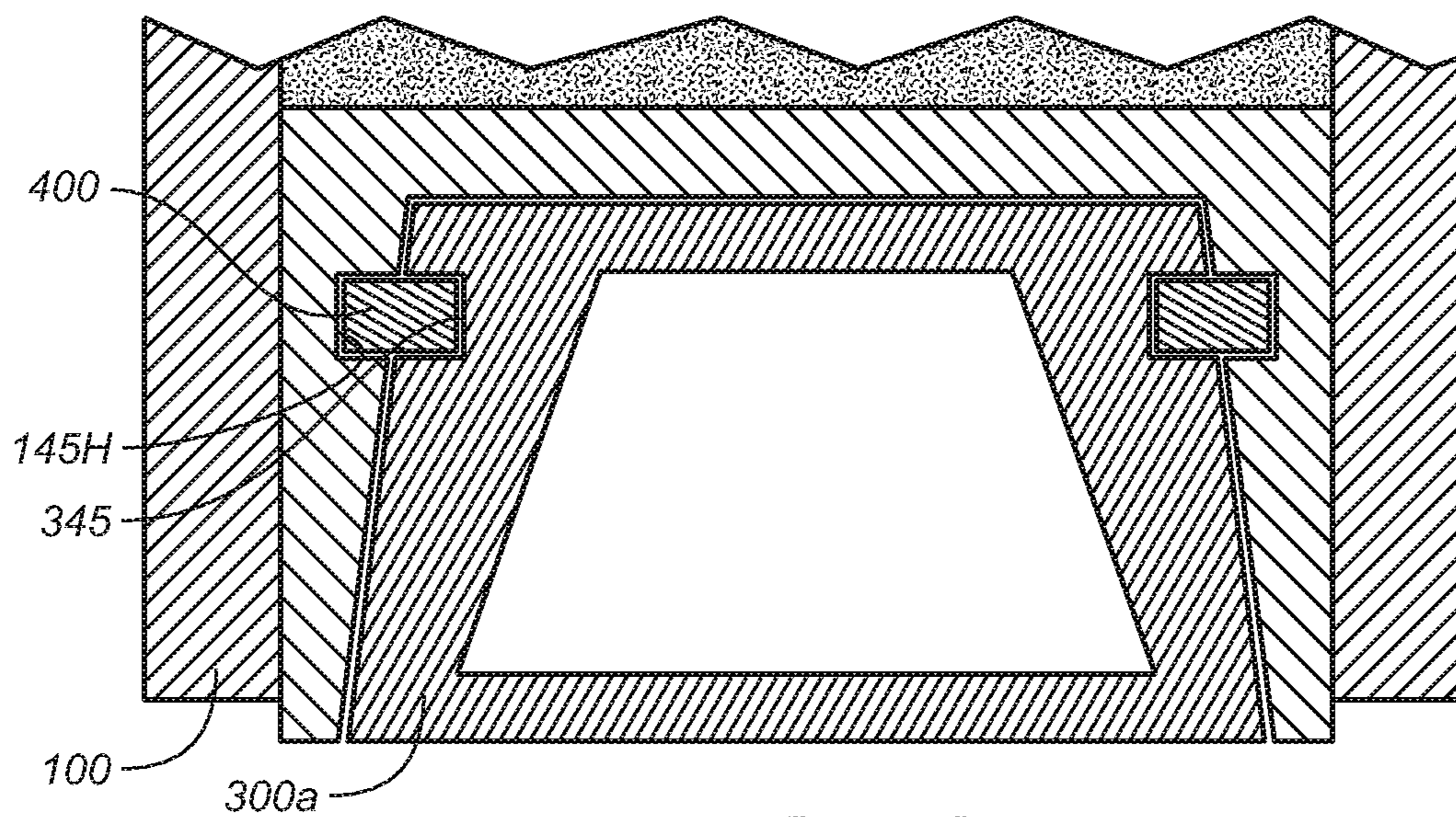
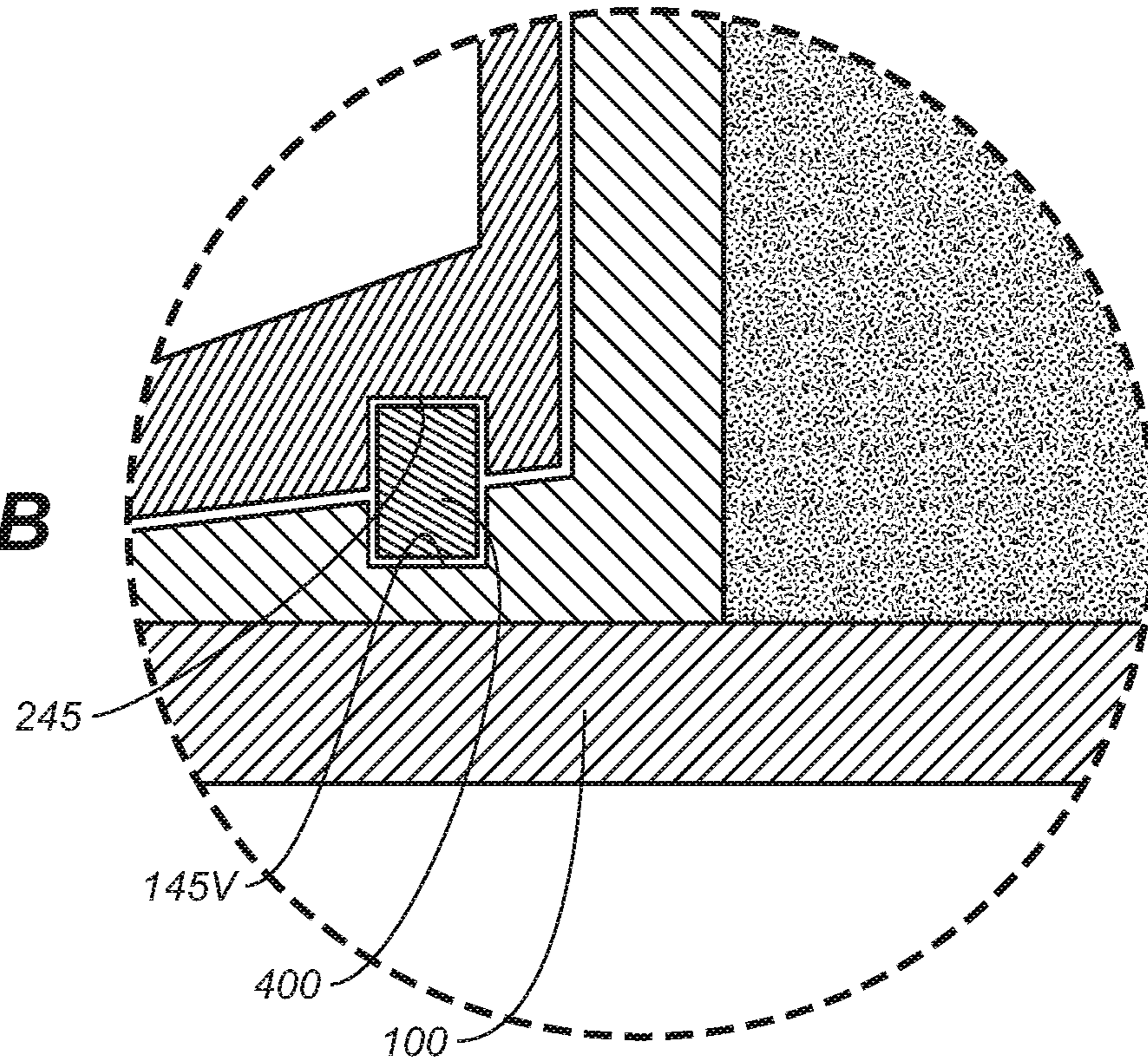


FIG. 8C

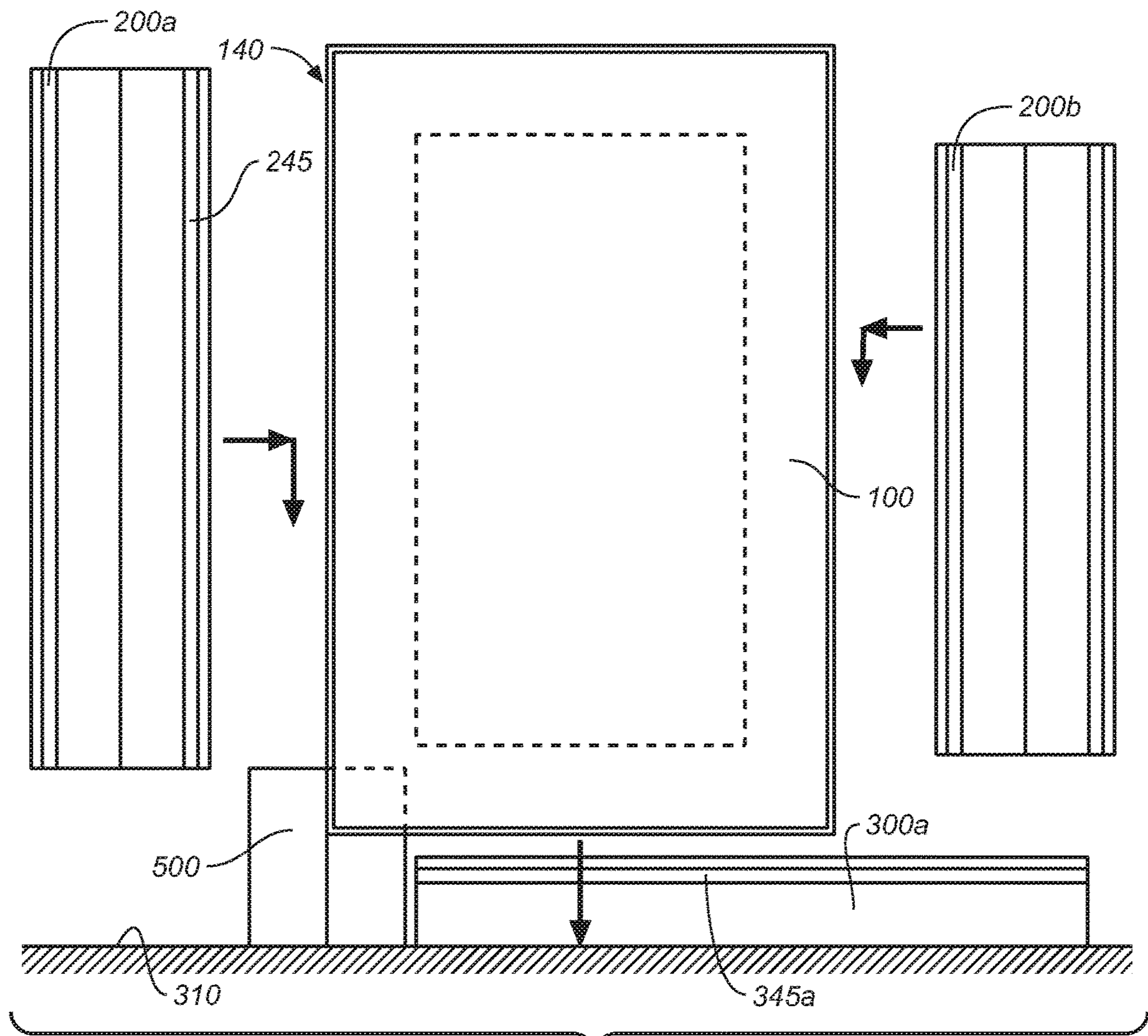


FIG. 9A

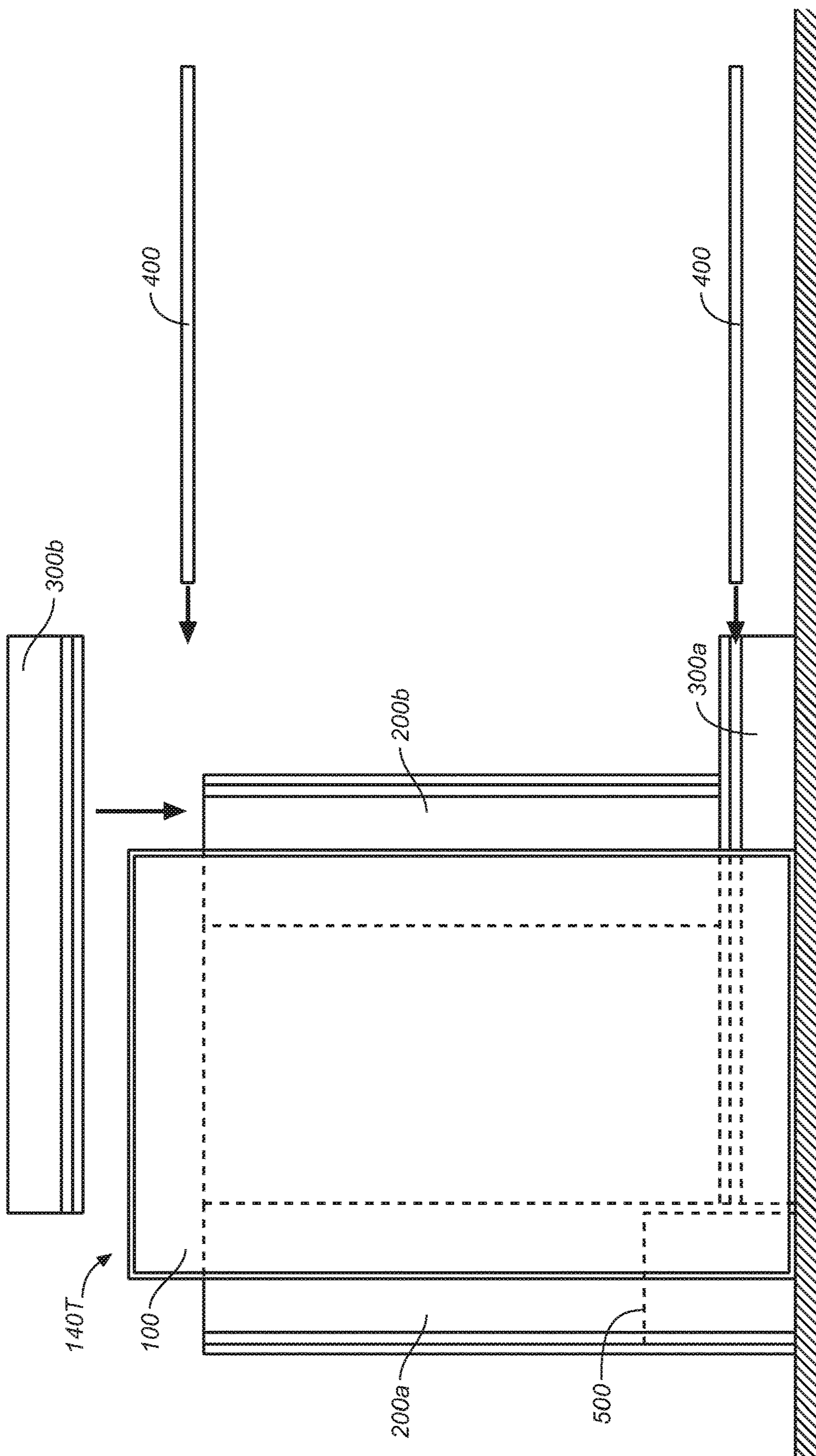
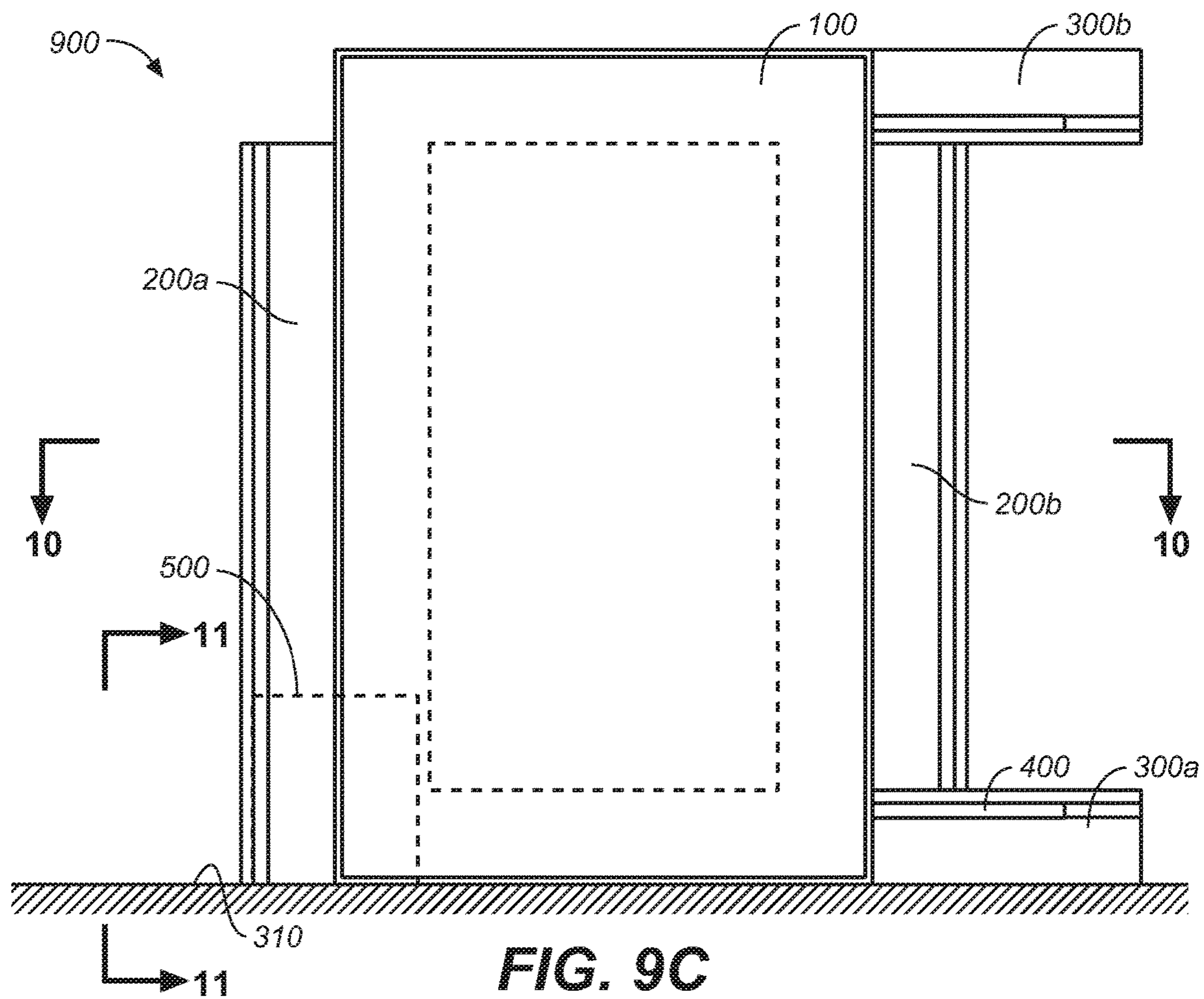


FIG. 9B



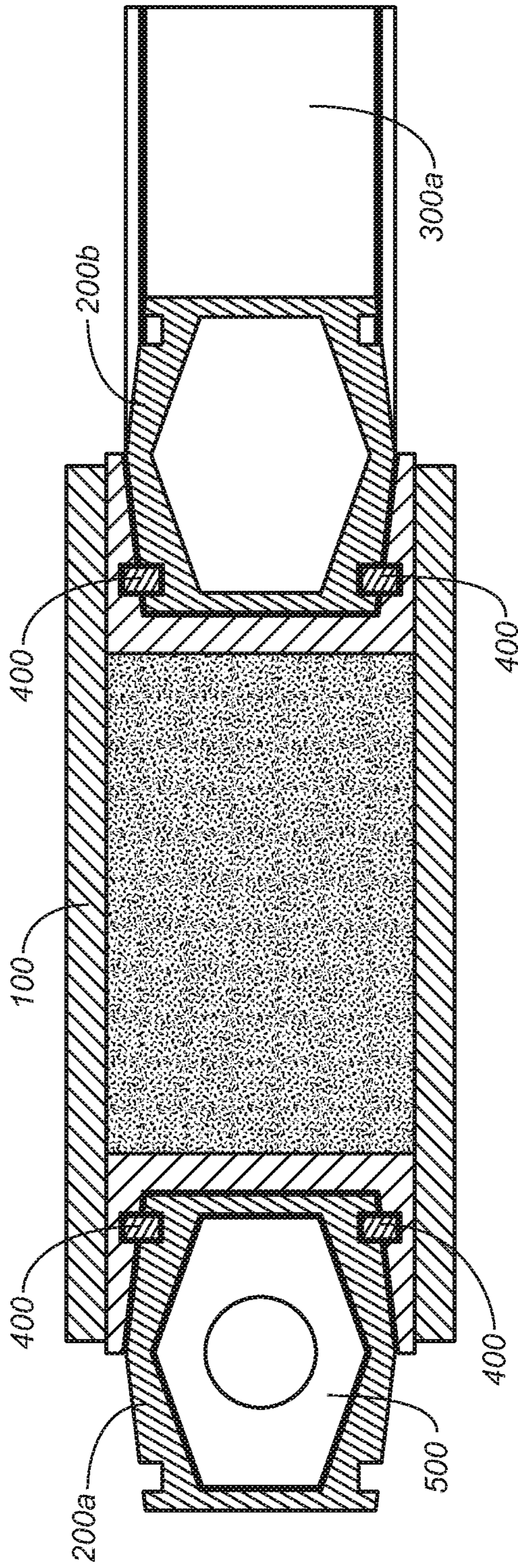


FIG. 10

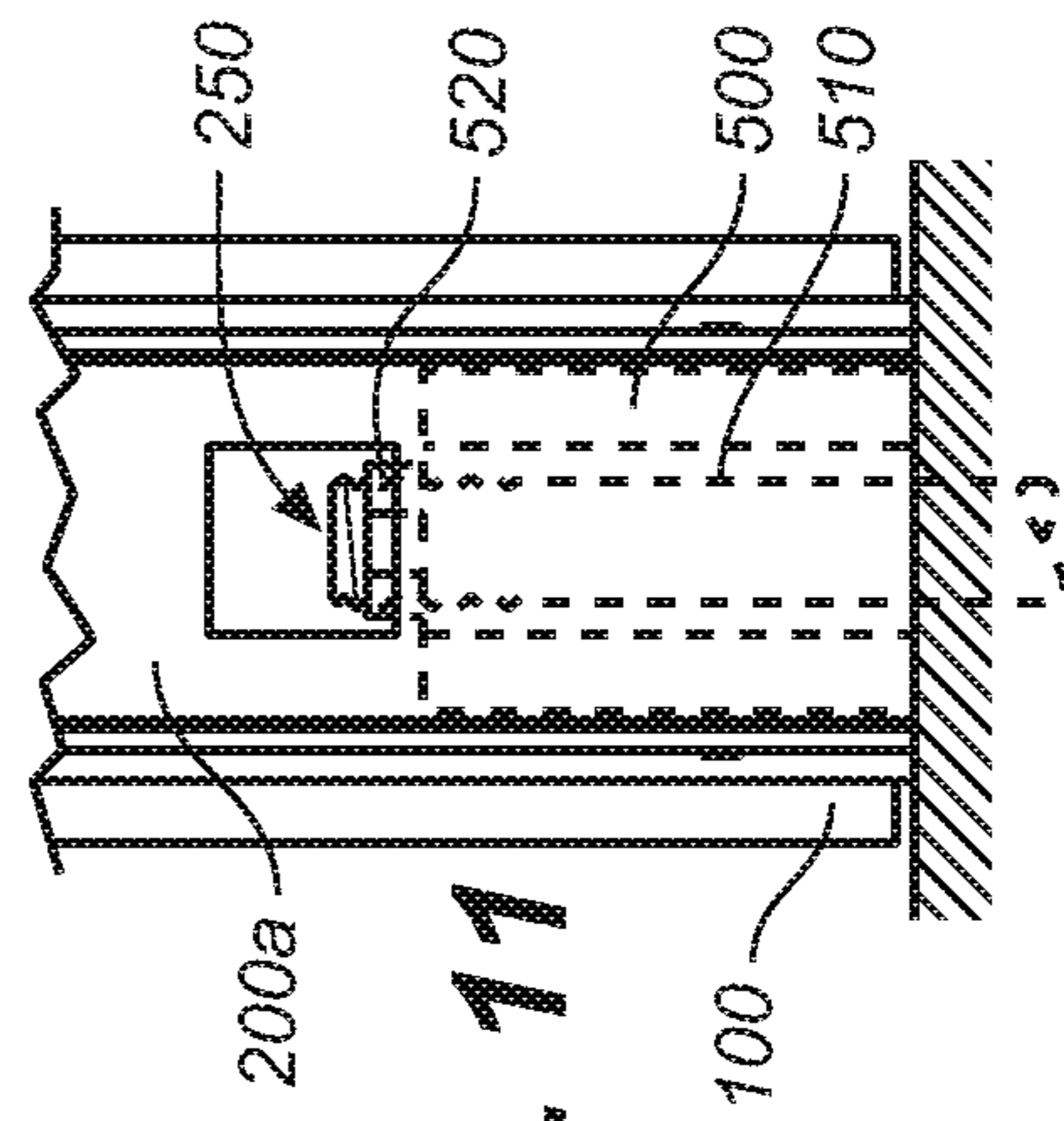


FIG. 11

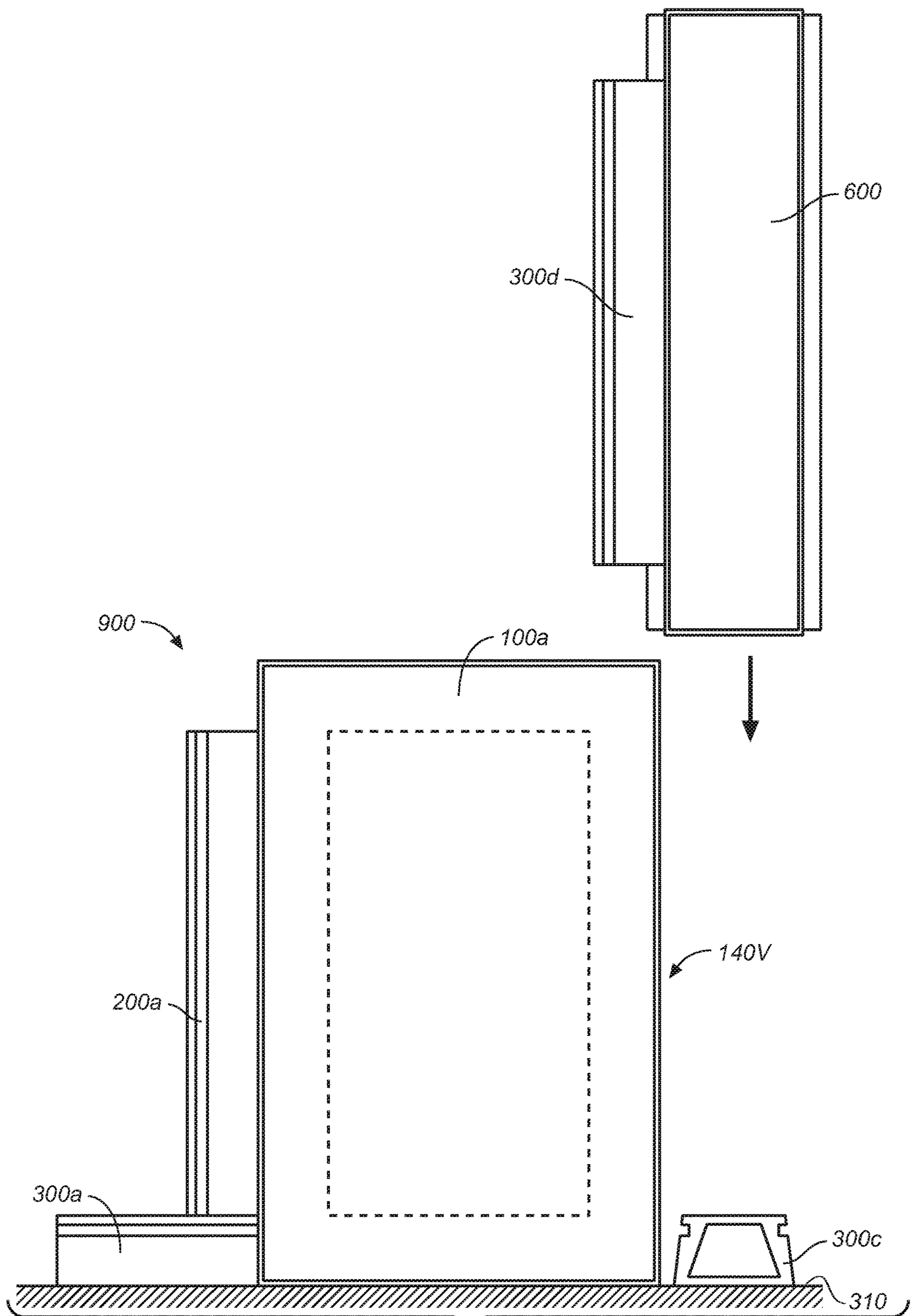


FIG. 12A

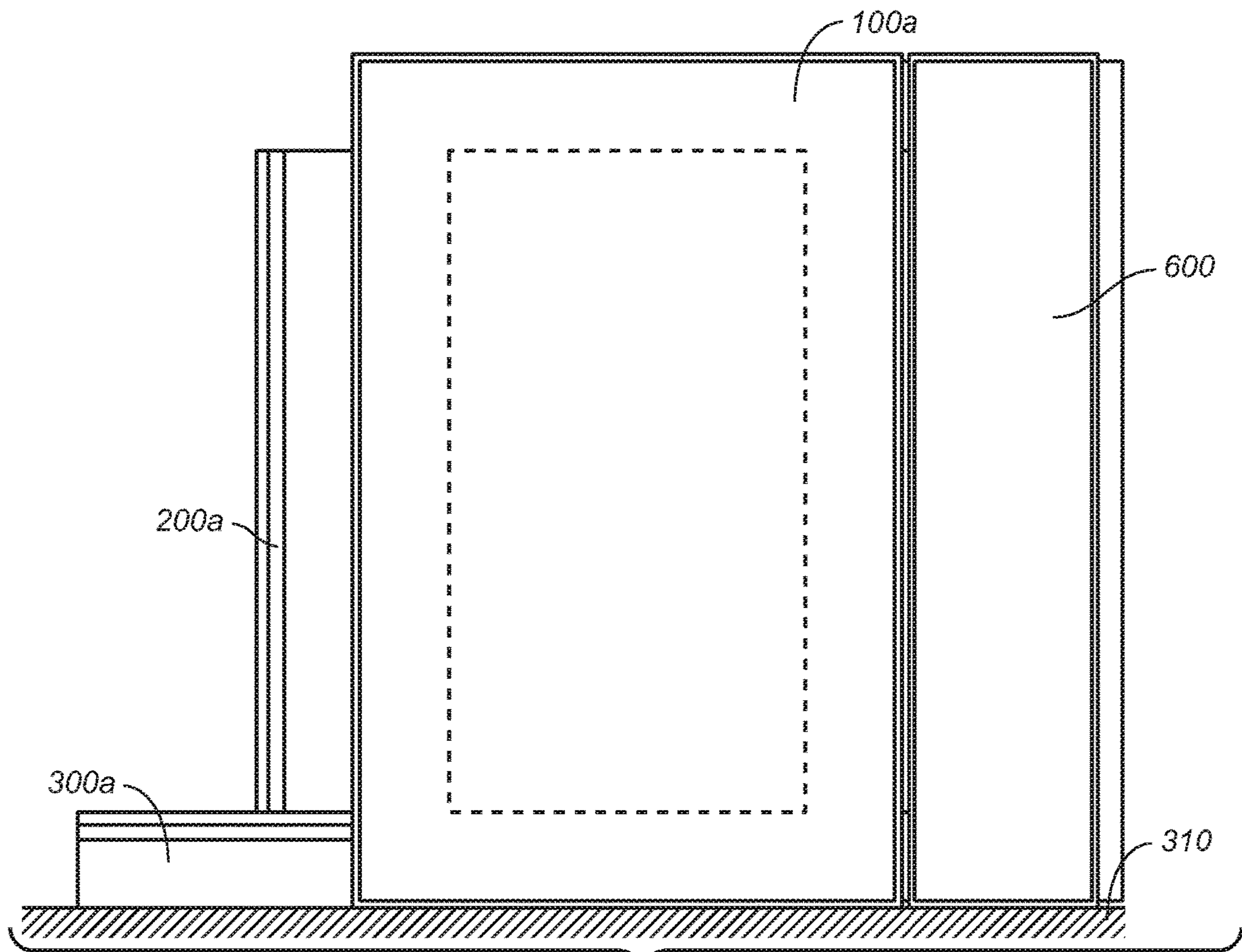


FIG. 12B

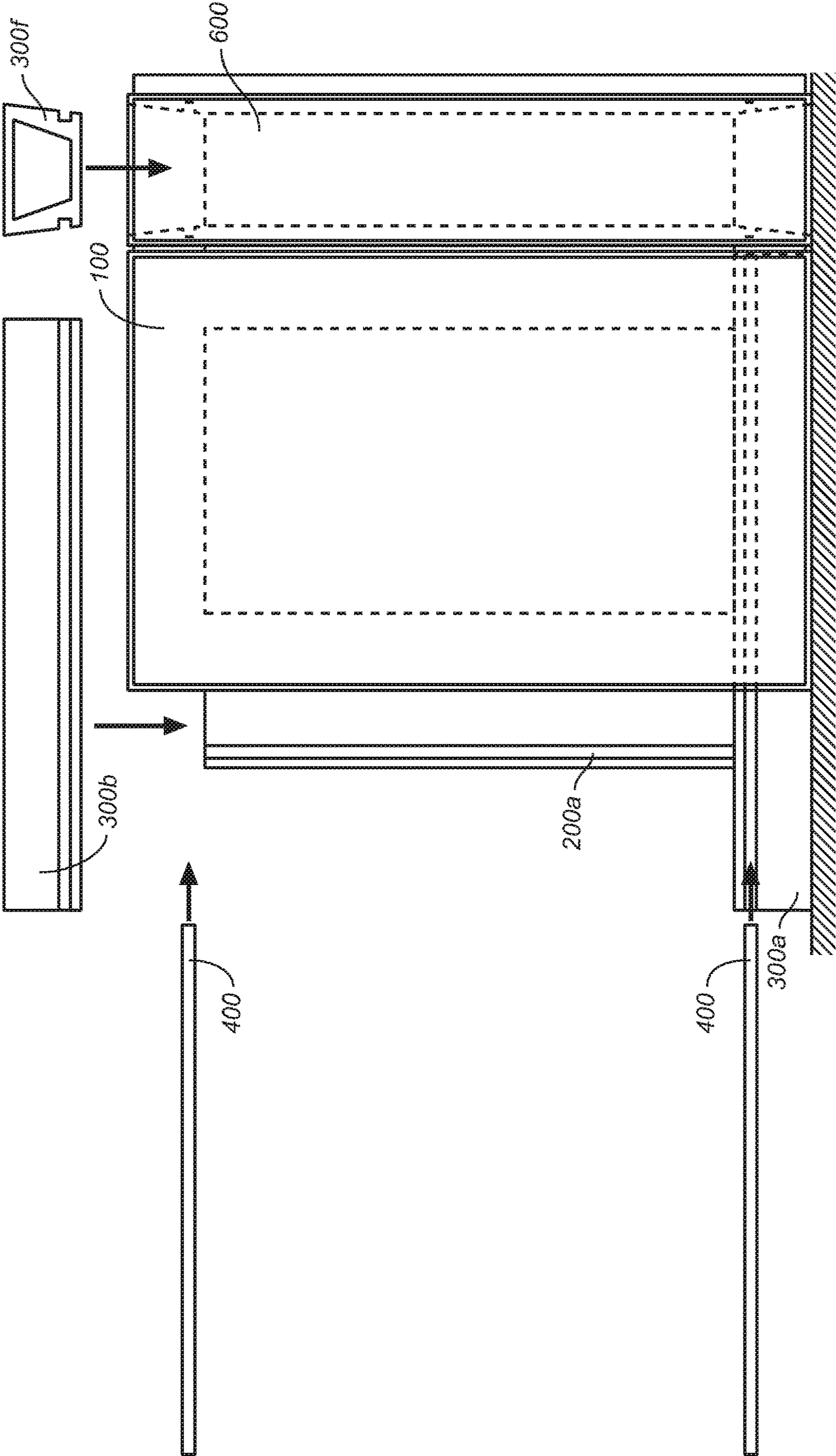


FIG. 12C

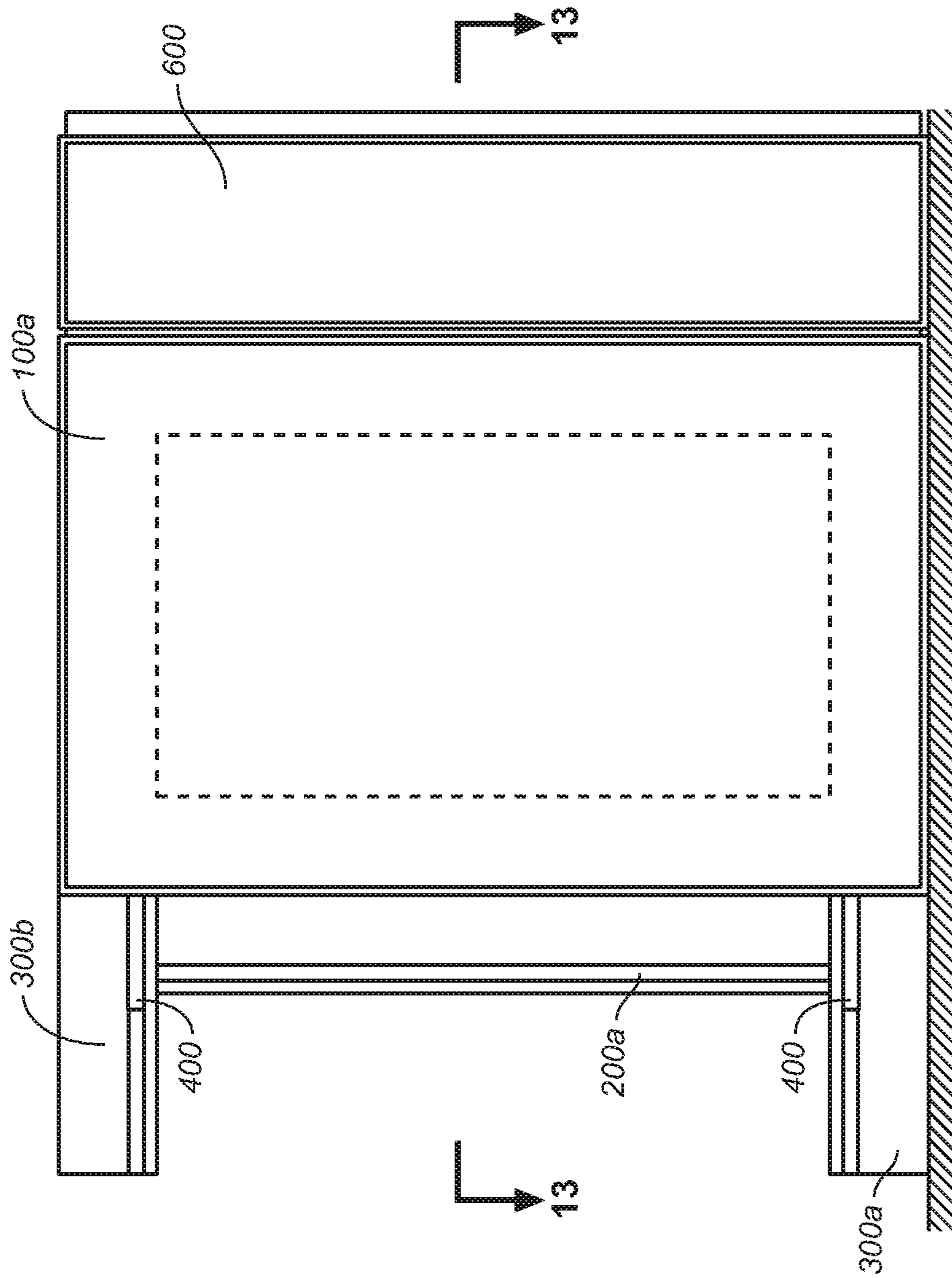


FIG. 12D

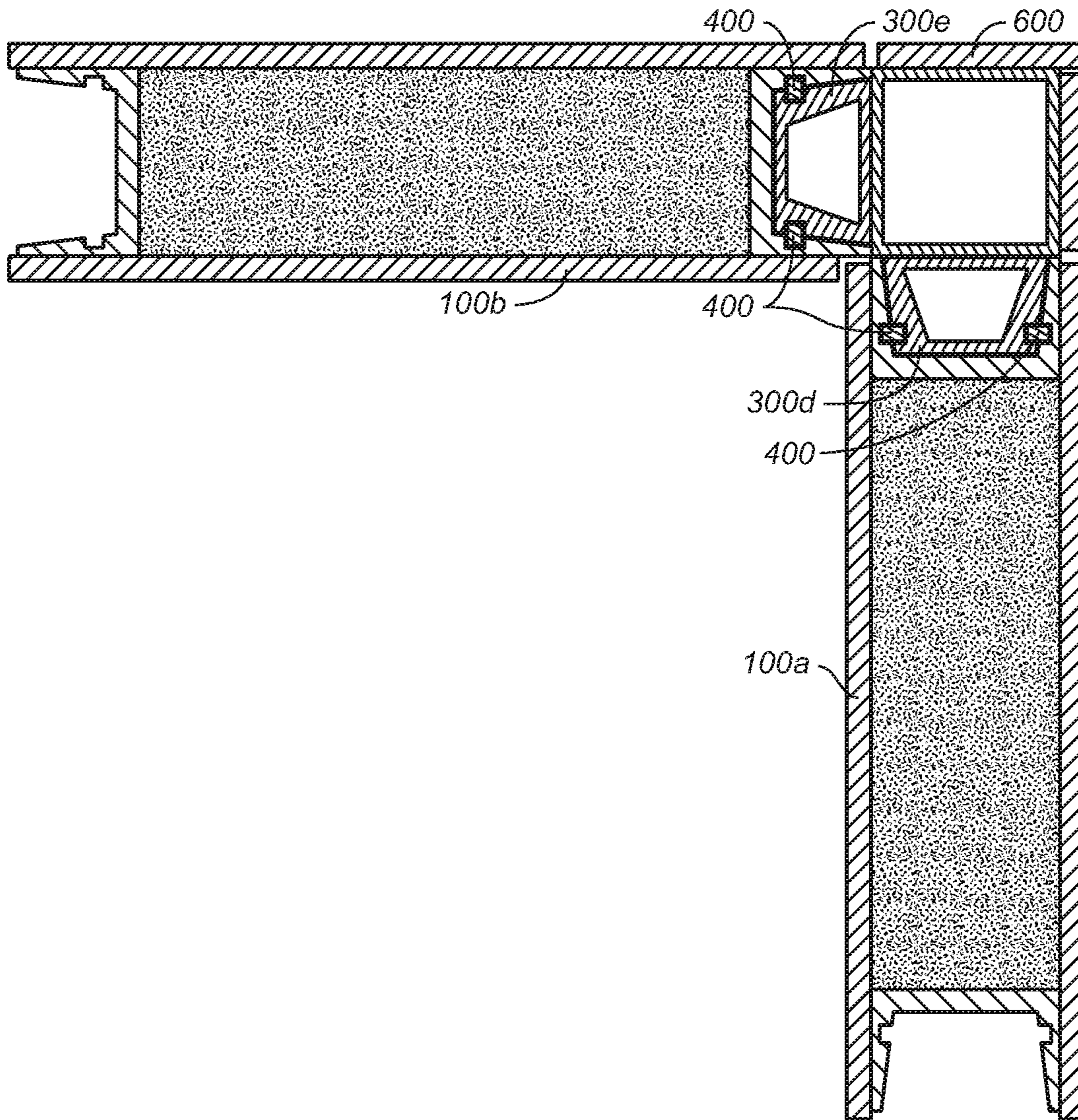


FIG. 13

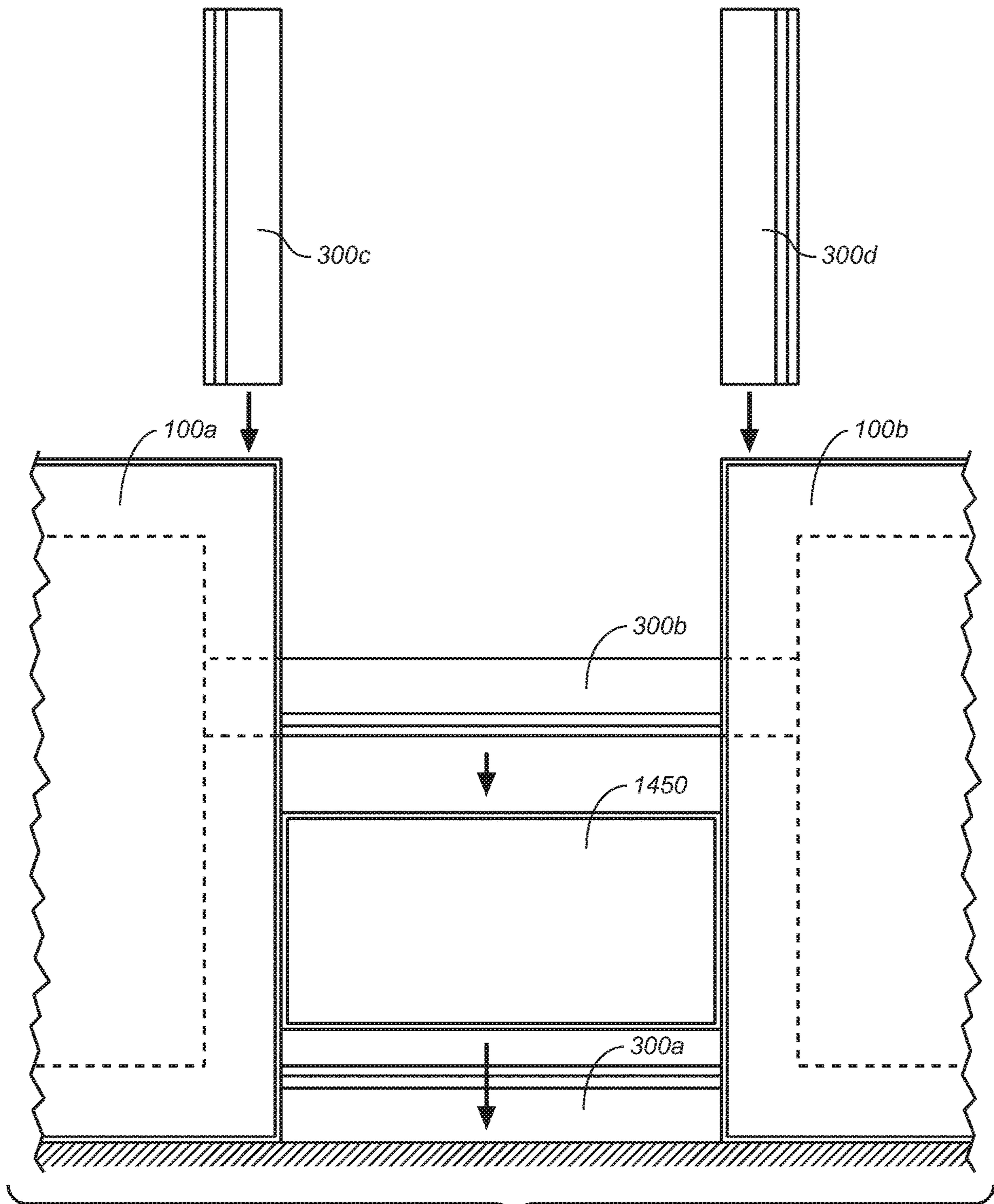


FIG. 14A

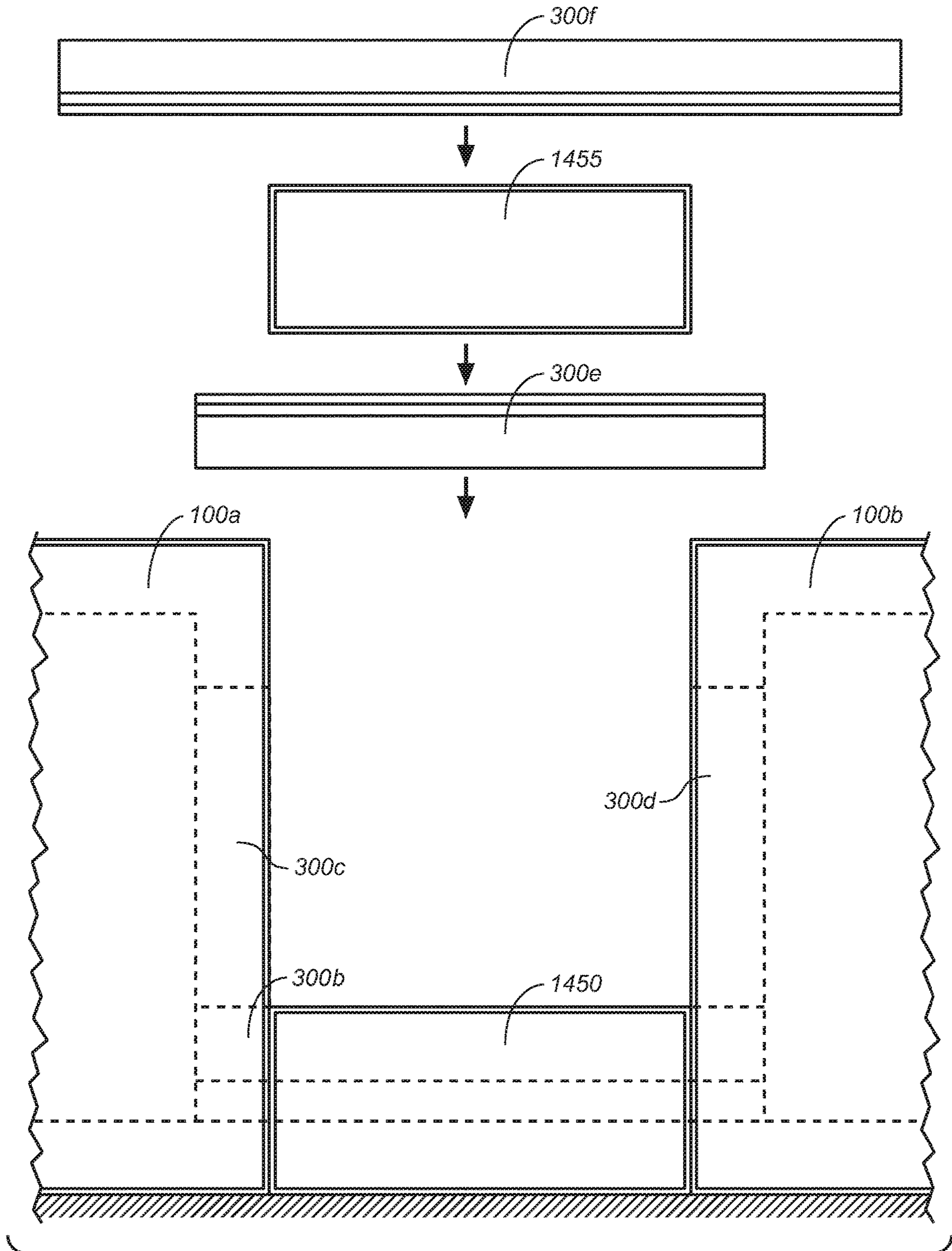


FIG. 14B

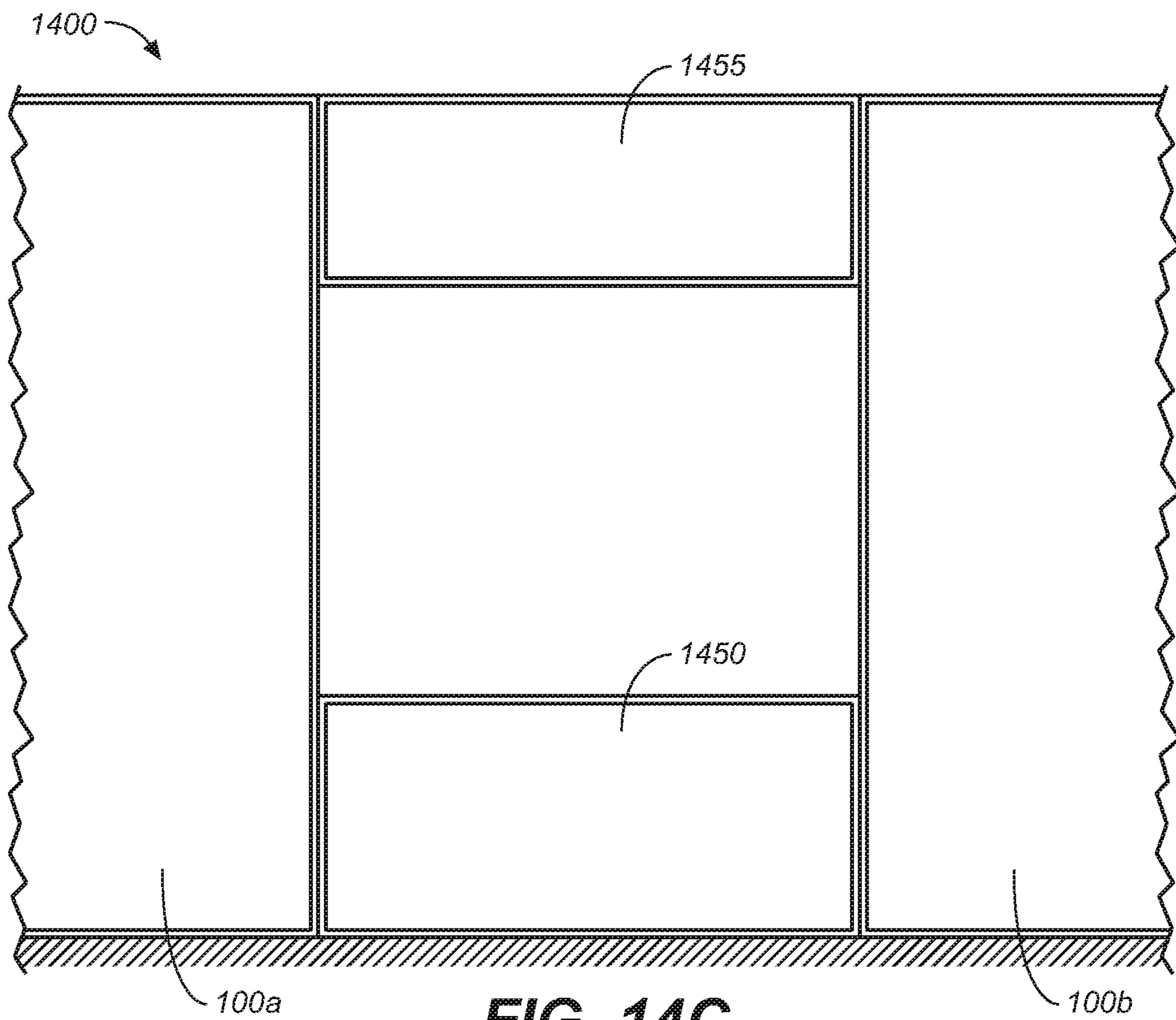


FIG. 14C

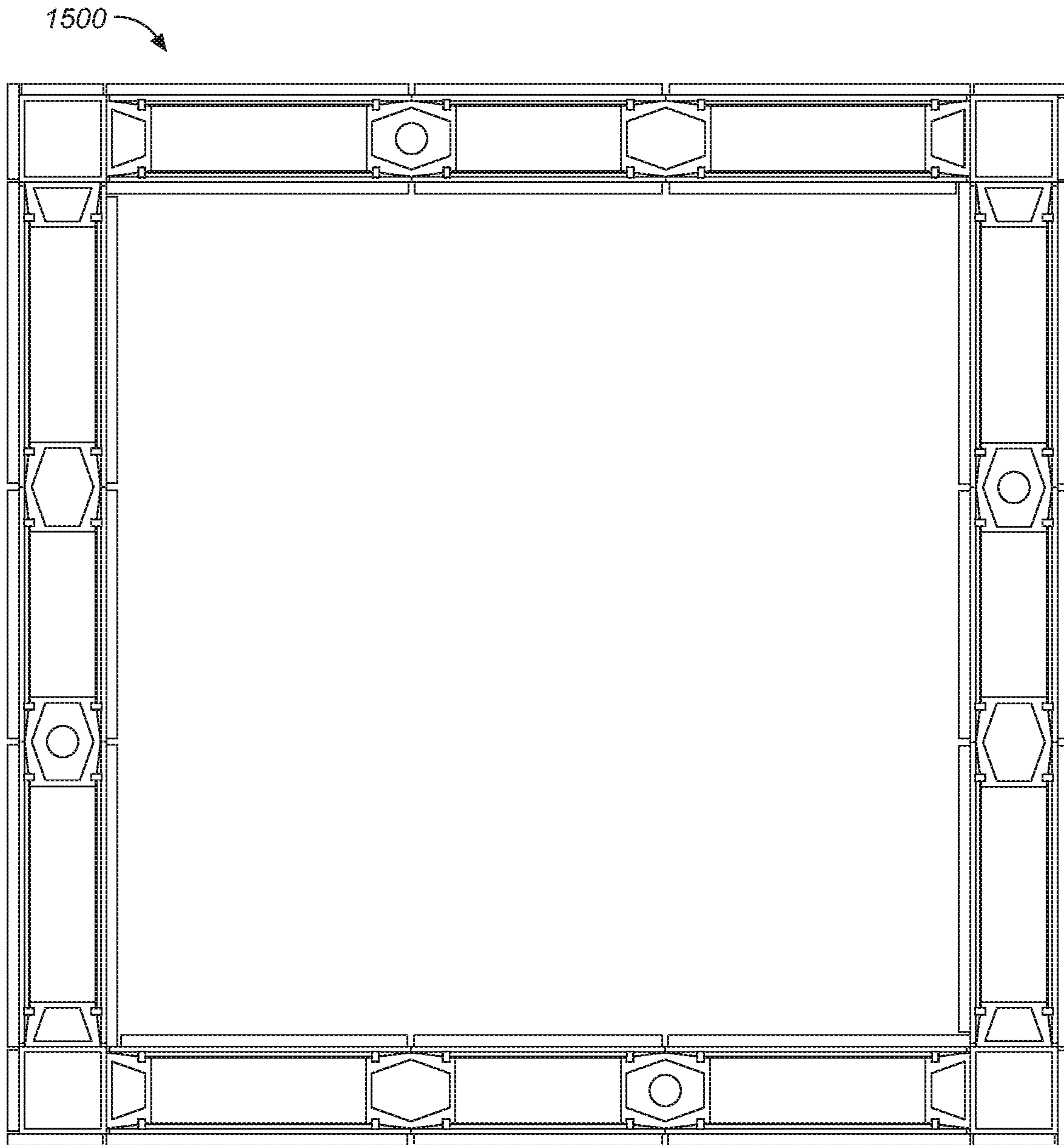


FIG. 15

SYSTEM AND METHOD FOR ASSEMBLING STRUCTURAL INSULATED PANELS

BACKGROUND

Field of the Invention

This invention relates to wall construction and, more particularly, relates to a system and method of assembling structural insulated panels (SIPs).

Discussion of the Prior Art

A structural insulated panel (SIP) is a building material consisting of an insulating layer of rigid core material sandwiched between two layers of structural board. SIPs can be used to construct walls, roofs, floors and foundation systems.

SIPs provide several benefits over conventional building framing materials. Although the cost of SIPs is typically higher than that of conventional building framing materials, a building using SIPs will generally have a tighter building envelope and superior insulating properties, leading to fewer drafts and reduced operating costs. In addition, SIPs generally come precut from the factory to conform to job specifications, such that the exterior building envelope can be built on-site quickly, reducing construction time and labor requirements. SIPs also tend to be lightweight and compact, reducing costs associated with the transportation of materials to the build site. As a result, the total life-cycle cost of a building constructed with SIPs can, in general, be lower than that of a conventionally framed building.

In addition, the environmental performance of SIPs is superior to conventionally framed construction due to superior thermal insulation, and SIPs address issues related to dampness and cold, such as compression shrinkage and cold bridging, more effectively than timber and other traditional building materials.

Prefabricated SIPs can, however, once transported to the building site, be difficult to align and securely interconnect to one another.

SUMMARY OF THE INVENTION

The present invention provides a system and method for fast and precise alignment, interconnection and installation of SIPs to form walls, floors, roofs or foundation systems. The system includes a set of splines that snugly insert into channels along the top, bottom and side edges of each SIP. Vertical alignment splines are used to align and interconnect adjacent SIPs and plate splines are used to cap edge channels of a SIP such that the edges of the SIP can securely rest on, support or be affixed to a foundation or other structural member. The system does not require the use of traditional fasteners, such as screws or nails, providing a further improvement over conventional building framing materials.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplary embodiments of the invention will now be described with reference to the accompanying drawings, in which:

FIG. 1 shows a structural insulated panel (SIP) having edge channels according to the invention.

FIG. 2 shows an alignment spline according to the invention.

FIG. 3 shows a plate spline according to the invention.

FIG. 4 shows a locking pin according to the invention.

FIGS. 5A and 5B show a hold-down block according to the invention.

FIG. 6 shows a corner assembly according to the invention.

FIGS. 7A to 7D illustrate a method of fitting and securing alignment splines and plate splines to the edge channels of a SIP according to the invention.

FIG. 8A shows a cross-sectional view, taken along line 8A-8A of FIG. 7D, of a SIP fitted with alignment splines and plate splines according to the invention.

FIG. 8B shows a detailed view, taken along line 8B of FIG. 8A, of an alignment spline secured to a SIP with a locking pin according to the invention.

FIG. 8C shows a cross-sectional view, taken along line 8C-8C of FIG. 7D, of a plate spline inserted into the bottom channel of a SIP and secured with a locking pin according to the invention.

FIGS. 9A to 9C illustrate a method of assembling a wall using the system of the invention.

FIG. 10 shows a cross-sectional view, taken along line 10-10 of FIG. 9C, of a portion of a wall assembled using the system of the invention.

FIG. 11 shows a side elevation view, taken along line 11-11 of FIG. 9C, of a portion of a wall assembled using the system of the invention.

FIGS. 12A to 12D illustrate a method of assembling a corner using the system of the invention.

FIG. 13 shows a top plan view of a portion of a corner assembled using the system of the invention.

FIGS. 14A to 14C illustrate a method of assembling a window or door frame using the system of the invention.

FIG. 15 shows a top plan view of a wall assembly constructed using the system of the invention.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

Referring to the drawings, FIG. 1 shows an embodiment of a SIP (100) having edge channels according to the invention. The SIP is made of a rigid core (110) of insulating material sandwiched between two layers of structural board (120, 122). The board layers (120, 122) can be made of magnesium oxide board (MgO), oriented strand board (OSB), sheet metal, plywood, cement or another suitable board material. The core (110) can be made of expanded polystyrene foam (EPS), extruded polystyrene foam (XPS), polyisocyanurate foam, polyurethane foam, composite honeycomb (HSC) or another suitable rigid core material.

Along the four edges 130 of the SIP, between the two layers of structural board, are top, bottom and vertical side edge channels (140T, 140B, 140V), each having an inner face (141) and two opposing tapered surfaces (142) extending between the inner face and one of the edges. An alignment spline (FIG. 2, 200) can be inserted into any of the vertical edge channels (140V) and a plate spline (FIG. 3, 300) can be inserted into the top or bottom edge channels (140T, 140B). Vertical edge channel key slots (145V) are disposed along and extend inwardly into the tapered surfaces (142) of the side edge channels (140V) as shown and align with alignment spline key slots (245) on an alignment spline (200) that is received in one of the side edge channels. Similarly, horizontal edge channel key slots (145H) disposed along and extending inwardly into the tapered surfaces (142) of top or bottom edge channels (140T, 140B) align with plate spline key slots (FIG. 3, 345) provided on a plate spline (300) that is received in either of the top or

bottom edge channels. Together, each pair of aligned key slots is cooperatively configured to form a locking channel to receive a locking pin (FIG. 4, 400) for securely locking the inserted alignment spline (200) or a plate spline (300) in place in one of the edge channels of the SIP (100).

As seen in FIG. 2, an alignment spline (200) forms a hexagonal cross-section, the opposing, symmetrical halves of which each conform to the shape of the edge channels (140) of the SIP (100), and which has a hollow core (270). The alignment spline can suitably have a differently shaped cross-section but should have mirror symmetry of a shape closely conforming to that of the edge channels of the SIP (100). The alignment spline allows two SIPs having standardized edge channels to be securely interconnected. The illustrated alignment spline shows each half having an end face (210) and two oppositely facing tapered faces (220) extending from the middle (230) of the spline to the end face (210). Each alignment spline has four outwardly facing alignment spline key slots (245), one extending into each of the tapered faces (220), that align with the vertical key slots (145V) on side edge channels (140V) to form locking channels (145V/140V) for receiving locking pins (400). An opening (250) on the side of the alignment spline provides access to a hold-down block (see FIGS. 5A and 5B), which may be received in the hollow core (270) of the alignment spline for securing the alignment spline to a foundation member, as discussed below with respect to FIGS. 9A and 11.

Referring next to FIG. 3, it can be seen that a plate spline (300) is effectively half of an alignment spline (200), or an alignment spline divided along a longitudinal plane. In the illustrated embodiment, the plate spline has a trapezoidal cross-section that closely conforms to the shape of the top and bottom edge channels (140T, 140B) of the SIP (100). The plate spline can be snugly inserted into one of the top or bottom edge channels of the SIP (100) to form a flat edge surface which can securely rest on or against, support or be affixed to a foundation or other anchoring member, as further discussed below with respect to FIGS. 7A to 7D. The illustrated plate spline (300) has two plate spline key slots (345) that align with horizontal key slots (145H) in the top or bottom edge channels (140T, 140B) of the SIP (100) to cooperatively form two locking channels (145H/345) for receiving locking pins (400). The hollow cores (270, 370) of both the alignment spline (200) and plate spline (300) can house electrical wiring or plumbing components.

One embodiment of a locking pin (400), as seen in FIG. 4, is configured to be inserted into a locking channel for securing either an alignment spline or plate spline to an edge channel of the SIP (100). An inserted locking pin (400) prevents outward movement or shifting of the inserted alignment spline (200) or plate spline (300) within the edge channel (140H, 140V). The key slots of the edge channels (140H, 140V), alignment spline (200) or plate spline (300) may be tapered from a wider width at their opening insert ends to a narrower width at their midpoints to facilitate insertion of the locking pin and to aid in the snug fitting of the alignment spline or plate spline within the edge channel.

The edge channels (140) of the SIP, alignment spline (200), plate spline (300) and locking pin (400), can all suitably be made of fiber reinforced plastic (i.e., fiberglass), which provides exceptional strength, as well as resistance to moisture buildup, mold and termites. Fiberglass is an exceptional material for use in buildings located in hurricane and flood prone areas. It should be understood, however, that the edge channels, splines and locking pins can be manufactured from other strong, high-performance materials.

With reference now to FIGS. 5A and 5B, a hold-down block (500) may be used in the formation of walls constructed using one or more SIPs (100), for securing a wall formation to a foundation. The hold-down block is anchored to the foundation using a suitable anchor bolt, such as the illustrated J-bolt (510), installed in a concrete foundation wall. The hollow core (540) of the hold-down block is sized large enough to loosely receive the anchor bolt (510) and such that an exact fit of the anchor bolt (510) within the hollow core (540) is not required. This provides some margin of error for the alignment of the hold-down block and anchor bolt components during installation.

With additional reference to FIGS. 9A-11, an alignment spline (200A) may be placed over the hold-down block (500) to secure the alignment spline in place. The top of the hold-down block may be tapered to facilitate receipt of the hold-down block (500) into the hollow core of the alignment spline (200A). Once the alignment spline is placed over the anchor bolt, a nut (520) and washer (530) can be accessed through the opening (250) on the side of the alignment spline (200a) to securely fasten the hold-down block with the anchor bolt to the foundation member (FIG. 5B).

Referring next to FIG. 6, a corner assembly (600) comprises a corner column (610) with structural board (620, 622) affixed to two of its faces and plate splines (300a, 300b) affixed to its other two faces. The corner column (610) is a hollow, rectangular extrusion of fiberglass or other strong material. As discussed in greater detail below with respect to FIGS. 12A to 13, the corner assembly (600) is used to construct a corner. Like the alignment spline and plate spline components, the corner assembly has a hollow core (670) that can house electrical wiring or plumbing components.

A method of fitting alignment splines (200a, 200b) and plate splines (300a, 300b) to the edge channels of a SIP (100) is now discussed with respect to FIGS. 7A-7D. In FIG. 7A, a bottom plate spline (300a) is affixed to a foundation member (310) and a SIP (100) is set on the foundation member with the bottom plate spline (300a) snugly received in the bottom edge channel (140B) of the SIP (100) (see FIG. 7B). Key slots (345a) in the bottom plate spline (300a) align with the horizontal key slots (145H) in the bottom edge channel (140B) of the SIP (100) forming locking channels (145H/345a).

Alignment splines (200a, 200b) are inserted into the vertical edge channels (140V) of the SIP (100). Key slots (245a, 245b) in the alignment splines (200a, 200b) align with vertical key slots (145V) in the vertical edge channels (140V) of the SIP (100) forming locking channels (145V/245).

As seen in FIG. 7B, locking pins (400) are inserted into the resulting locking channels (145V/245) of the alignment splines (200a, 200b) and vertical edge channels (140V) for securing the alignment splines (200a, 200b) to the SIP (100). As seen in FIG. 7C, locking pins (400) are inserted into the locking channels (145H/345a) of the bottom plate spline (300a) and the bottom edge channel (140B) of the SIP (100) for securing the bottom plate spline (300a) to the SIP (100).

As shown in FIG. 7D, a top plate spline (300b) is inserted into the top edge channel (140T) of the SIP (100), with the key slots (345b) of the top plate spline (300b) aligning with the horizontal key slots (145H) of the top edge channel (140T) of the SIP (100). The top plate spline (300b) is locked into the top edge channel (140T) with locking pins (400).

As shown in FIGS. 8A-8B, the alignment splines (200a, 200b) are snugly received in the vertical edge channels (140V) of the SIP (100) and the locking pins (400) are snugly received in the locking channels (145V/245). The

tight fit of the inserted locking pins (400) within the locking channels (145V/245) prevents outward movement or shifting of the alignment splines (200a, 200b), thus securing the alignment splines (200a, 200b) within the vertical edge channels of the SIP (100).

In FIG. 8C, the bottom plate spline (300a) is shown snugly received in the bottom edge channel (140B) of the SIP (100) and two locking pins (400) are snugly received in the horizontal locking channels (145H/345). The tight fit of the inserted locking pins (400) prevents movement or shifting of the SIP (100) on the bottom plate spline (300a). The top plate spline (300b) is securely locked into the top edge channel (140T) of the SIP (100) in similar fashion (see FIG. 7D).

A method of fitting alignment splines and plate splines to the edge channels of a SIP to form a wall, and to secure the wall to a foundation using a hold-down block (500), is now discussed with reference to FIGS. 9A-9C. In FIG. 9A, a hold-down block (500) is secured to a foundation member (310) with an anchor bolt. A first alignment spline (200a) is inserted into a vertical edge channel (140V) of the SIP (100) and slid over the hold-down block (500). As shown in FIG. 11, the opening (250) on the side of the first alignment spline (200a) provides access to the nut (520) and washer (530) used to secure the hold-down block (500) to anchor bolt (510). In another embodiment, not illustrated, locking pins or other fasteners may be used to secure the first alignment spline (200a) to the hold-down block (500). A second alignment spline (200b) is inserted into the other vertical edge channel (140V) of the SIP (100) and locking pins (400) are used to secure both alignment splines (200a, 200b) to the SIP (100).

In FIGS. 9B-9C, a top plate spline (300b) is inserted into the top edge channel (140T) of the SIP and locking pins (400) are inserted into the locking channels formed by the aligned key slots of the plate splines (300a, 300b) and the horizontal edge channels (140V) of the SIP (100), securing both plate splines (300a, 300b) to the SIP (100).

FIG. 10 shows a detailed view of the interconnected SIP (100), alignment splines (200a, 200b), hold-down block (500) and plate spline (300a).

A method of assembling a corner with two SIPs (100a, 100b) according to the invention is now described with respect to FIGS. 12A-13. As seen in FIG. 12A, with the first SIP (100a) set into place, another bottom plate spline (300c) is affixed to the foundation member (310), perpendicular to the SIP (100a). A corner assembly (600) is then lowered over the affixed bottom plate spline (300c) and one of the corner assembly plate splines (300d) is received in the open vertical edge channel (140V) of the SIP (100a), securing the corner assembly (600) to the foundation (310) and the first SIP (100a), as shown in FIG. 12B. The second SIP (100b) is then secured to the corner assembly (600) by receiving the other corner assembly plate spline (300e) in a vertical edge channel of the second SIP (100b), as shown in FIG. 13. In FIGS. 12C-13, top plate splines (300b, 3000) are inserted into the top edges of the SIPs (100, 100b) and secured with locking pins (400) to form flat top edge surfaces on the SIPs (100, 100b), completing the corner.

A method of assembling a window or door frame using the system of the invention is now discussed with respect to FIGS. 14A-14C.

In FIG. 14A, two wall SIPs (100a, 100b) are interconnected with a gap therebetween by a bottom plate spline (300a). A bottom frame SIP (1450) is installed on the bottom plate spline, (300a) and a first intermediate plate spline (300b) is installed in the top edge channel of the bottom

frame SIP (1450). Vertical plate splines (300c, 300d) are then inserted into the vertical edge channels of the two wall SIPs (100a, 100b).

In FIG. 14B, a second intermediate plate spline (300e) is inserted into the vertical edge channels of the two wall SIPs (100a, 100b) where it rests on top of the vertical plate splines (300c, 300d) secured therein. A top frame SIP (1455) is then disposed on the second intermediate plate spline (300e) and a top plate spline (300f) is inserted into the top edges of the two wall SIPs (100a, 100b) and the second frame SIP (1455). Throughout the various steps of assembling, locking pins (not shown) are used to secure the interconnected wall components. The completed window or door frame (1400) is shown in FIG. 14C.

FIG. 15 shows a top plan view of a wall assembly (1500) constructed according to the steps for constructing walls and corners as shown and described in FIGS. 9A-9C and 12A-12D.

Beyond use in building construction, the splines, hold-down blocks and locking pins of the invention can be sized for small-scale applications, such as for interconnecting the panels of a scale model or toy construction set.

Certain embodiments of a system and method for precisely aligning, interconnecting and securing SIPs have thus been described and illustrated herein in detail. These embodiments are merely exemplary implementations of the invention and are not to be taken as limiting, the spirit and scope of the invention being limited only by the terms of the appended claims and their legal equivalents.

I claim:

1. A system for assembling structural insulated panels, the system comprising:

a structural insulated panel (SIP) having one or more edges, at least one of said one or more edges including an edge channel extending into at least one of said one or more edges, the edge channel having an inner face and two opposing tapered surfaces extending between the inner face and the one or more edges, and an edge channel key slot extending into at least one of said opposing tapered surfaces,

an alignment spline having symmetrical halves, each symmetrical half including two oppositely facing tapered faces complementary to the tapered surfaces of said edge channel and having an alignment spline key slot extending into at least one of said two oppositely facing tapered faces of said alignment spline,

a locking pin, and

an assembled configuration in which one of the symmetrical halves of the alignment spline is disposed in the edge channel of the SIP, the edge channel key slot is aligned with the alignment spline key slot cooperatively forming a locking channel, and the locking pin is disposed in the locking channel thereby securing the alignment spline to the SIP.

2. The system for assembling structural insulated panels of claim 1 wherein:

the alignment spline has a polygonal cross-section.

3. The system for assembling structural insulated panels of claim 2 wherein:

said polygonal cross-section is hexagonal.

4. The system for assembling structural insulated panels of claim 1 wherein: said one or more edges includes two side edges, each of said two side edges having a side edge channel.

5. The system for assembling structural insulated panels of claim 4 wherein: said one or more edges includes top and bottom edges, the top edge having a top edge channel, the

7

bottom edge having a bottom edge channel, each of said top edge and bottom edge channels having two opposing tapered surfaces and an edge channel key slot extending into at least one of said two opposing tapered surfaces.

6. The system for assembling structural insulated panels of claim 5 further comprising:

a plate spline including an outer face and two oppositely facing tapered faces complementary to the two opposing tapered surfaces of said top and bottom edge channels, and a plate spline key slot extending into at least one said two oppositely facing tapered faces, and a second locking pin,

wherein, in the assembled configuration, the plate spline is disposed in one of the top edge channel and the bottom edge channel, the plate spline key slot is aligned with the edge channel key slot of one of the two opposing tapered surfaces of said top or bottom edge channel to form a second locking channel, the second locking pin is disposed in the interior of the second locking channel thereby securing the plate spline to the SIP, and the outer face of the plate spline forms a flat surface along one of said top and bottom edges of the SIP.

7. The system for assembling structural insulated panels of claim 1 wherein:

the alignment spline has a hollow core.

8. The system for assembling structural insulated panels of claim 7 further comprising:

a hold-down block configured to be secured to a building foundation and configured to be disposed in the interior of the hollow core of said alignment spline for restriction of lateral movement of the alignment spline with respect to the building foundation.

9. The system for assembling structural insulated panels of claim 8 further comprising:

a fastening mechanism for securing the hold-down block to the building foundation,

the alignment spline having a plurality of faces and an opening in one of said faces for providing access to the fastening mechanism for securing the hold-down block that has been received in the hollow core of the alignment spline to the building foundation.

10. A system for assembling structural insulated panels, the system comprising:

a structural insulated panel (SIP) having two oppositely facing side edges, an edge channel extending into at least one of the two side edges, the edge channel having an inner face and two opposing tapered surfaces extending between the inner face and the two oppositely facing side edges, and an edge channel key slot extending into at least one of said two opposing tapered surfaces,

an alignment spline having a plurality of faces, a hollow core, and a hexagonal cross-section including symmetrical halves, each of said symmetrical halves including two oppositely facing tapered faces corresponding to the two opposing tapered surfaces of said edge channels and having an alignment spline key slot extending into at least one of said two oppositely facing tapered faces,

a hold-down block configured to be secured to a building foundation and configured to fit into the hollow core of said alignment spline for restriction of lateral movement of the alignment spline with respect to the building foundation, one of said plurality of faces of said alignment spline having an opening for providing

8

access to a fastening mechanism for securing said hold-down block received in the hollow core of the alignment spline to a building foundation,

a locking pin, and

an assembled configuration in which the hold-down block is disposed in the interior of the hollow core of the alignment spline and is secured to the building foundation, one of the halves of the alignment spline is disposed in the interior of one of the edge channels of the SIP, the edge channel key slot of said one of the edge channels is aligned with the alignment spline key slot of the alignment spline to form a locking channel, and the locking pin is disposed in the interior of the locking channel thereby securing the alignment spline to the SIP.

11. The system for assembling structural insulated panels of claim 10 wherein:

said SIP further includes top and bottom edges, each of said top and bottom edges including an edge channel.

12. The system for assembling structural insulated panels of claim 10 further comprising:

a plate spline having the shape of one of the halves of the alignment spline, the plate spline including an outer face and two oppositely facing tapered faces complementary to the two opposing tapered surfaces of said top and bottom edge channels and having a plate spline key slot extending into at least one of said two oppositely facing tapered faces, and

a second locking pin,

wherein, in the assembled configuration, the plate spline is disposed in one of the top edge channel and the bottom edge channel, the plate spline key slot is aligned with the edge channel key slot of one of the two opposing tapered surfaces of said top or bottom edge to form a second locking channel, the second locking pin is disposed in the interior of the second locking channel thereby securing the plate spline to the SIP, and the outer face of the plate spline forms a flat surface along one of said top and bottom edges of the SIP.

13. The system for assembling structural insulated panels of claim 1 wherein:

said SIP includes two spaced-apart parallel structural boards,

said edge channel includes an inner face that is perpendicular to and extends between said structural boards, and

said two opposing tapered surfaces extend between said inner face and said at least one edge.

14. The system for assembling structural insulated panels of claim 13 wherein:

the symmetrical halves extend from a middle of said alignment spline,

each half of said alignment spline includes an outer face, and

said two oppositely facing tapered faces extend from the middle of the alignment spline to the opposite end of said outer face.

15. The system for assembling structural insulated panels of claim 1 wherein:

said first edge channel key slot is facing inward toward said edge channel, and

said alignment spline key slot is facing outward away from one of said two oppositely facing tapered faces of said alignment spline.

* * * * *